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PREHISTORIC PROBLEMS

BEING

A SELECTION OF ESSAYS ON THE EVOLUTION OF MAN AND OTHER CONTROVERTED PROBLEMS IN ANTHROPOLOGY AND ARCHÆOLOGY

BY

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&c., &c.

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PREFACE.

OF the original papers which form the nucleus of this volume, that "On the Relation between the Erect Posture and the Physical and Intellectual Development of Man," which formed the Presidential Address at the Anthropological Section of the British Association in 1893, alone remains unchanged. Previous to that time the erect posture had not, to my knowledge, been regarded as an important factor in the evolution of man, but more recently opinions tending in that direction have emanated from several quarters. I consider, therefore, that whatever value may be attached to the views then expressed, it is better now to leave them in the actual garb in which they originally appeared; more especially as I regard the fossil bones discovered by Dr Dubois, in Java, as a practical illustration of their truth. Readers have thus an opportunity of comparing conclusions, arrived at in a mere academical essay, with a description of the actual remains of a being

which, undoubtedly, is the oldest known link between civilised man and the brute creation. The few additions made to this chapter are, therefore, in the form of footnotes. In this way I have the privilege of introducing some important observations on the mechanism of the human foot, which were expressed by the late Professor Huxley in a friendly communication to myself. On receipt of his letter, I wrote asking permission to print his remarks as a comment on that portion of my address, as I then fully intended to carry out his suggestion of publishing it in a more permanent form without delay. To this request he replied (3d December 1893) as follows: "I hope you will carry out your intention of republishing your essay. As to what I said about the foot, pray make any use of it you see fit."

The chapters on "Fossil Man" and "Intermediary Links," although read at Societies in Edinburgh (the former at the Royal Physical Society, February 17, 1897, and the latter at the Royal Society, January 4, 1897), were virtually written for this volume, with the object of giving a more practical shape to the views set forth on the causes of the higher brain-development of man.

A portion of the chapter on the "Rise and Progress of Anthropology" formed an address to the Royal Society of Edinburgh, delivered at the request of the Council, May 7, 1894. The additional matter now incorporated with it has enabled me to present the

subject in a less scrappy manner than was possible within the limits of a single address, and also to bring the sketch later down so as to cover some of the more recent researches.

The first portion of the article on "Prehistoric Trepanning and Cranial Amulets" was published in the 'Fortnightly Review,' February 1893; but the subject-matter is now considerably enlarged by the addition of further discoveries.

The remarkable story unfolded by the correlation of these so-called *Otter* and *Beaver* traps is a continuation of that communicated to the Society of Antiquaries of Scotland, January 12, 1891. At that time I could find evidence of only *eleven* traps; now they number *thirty-five.* The records of the discovery of these mysterious machines, and of the various speculations propounded as to their function, supply the materials of an instructive object-lesson in comparative archæology.

The notes on "Bone Skates" were also a communication to the same Society on March 12, 1894; and in reproducing them here few changes have been made, beyond a slight increase in the number of bone skates recorded.

Part I. of the chapter on "Prehistoric Saws and Sickles" was read at the Anthropological Section of the British Association in September 1893, and published the following December in the 'Illustrated Archæologist.' In the present work the subject is continued so as to

embrace the modifications entailed in the structure of these implements, by the introduction of bronze and iron into Europe.

The archæological articles are more especially intended to illustrate the methods and results of comparative archæology; but, apart from this, I trust none of them will be found barren of interest to those who are anxious to keep themselves *au courant* with the general progress of archæology.

The special feature of the book is, however, the attempt to correlate the phenomena of man's environments (chapters ii., iii., and iv.) with the corporeal changes necessitated by his higher intelligence, and to place a summary of the results before general readers. Nor is it necessary to offer any apology for ventilating in public the opinions thus formulated; for the story of the development of man can never cease to have a fascination to his living representatives, so long as their supremacy in the organic world is upheld by virtue of the moral and reasoning faculties. The great altruistic world of Ethics is a secondary growth, and subsequent to the phenomena with which we are more immediately concerned. Our data go back to the primary rootlets of that marvellous process of cerebration by means of which man has become, *par excellence*, a reflective being, and a governing power on this globe. It is the story of an event unique in the organic world — an event which has already culminated in his laying a usurping

hand on the reins of Cosmic evolution. Next to the method of natural selection by "survival of the fittest," there is no more conspicuous landmark in the evolutionary career of man than that which signalises the co-ordination of manipulative skill with progressive intelligence.

The great diversity of the materials thus discussed has correspondingly increased my obligations to fellow-workers. It would, indeed, be tedious to specify in detail the amount of assistance I have received, both *viva voce* and by correspondence, from curators of museums and private collectors, in bringing together so many facts from the different areas covered by these essays. I cannot, however, refrain from specially acknowledging the services of the following gentlemen: Dr Conwentz, Danzig; Dr Voss, Berlin; Dr Meschinelli and Sig. Lioy, Vicenza; the late Dr Deschmann and Professor Müllner, Laibach; the late Dr Rambotti, Desenzano; Dr Forbes, Liverpool; Professor Duns, Edinburgh; Mr H. Allingham, Ballyshannon; Dr Fraser, Dublin; Mr W. Knowles, Ballymena; and the late Canon Grainger, Broughshane.

I am also indebted to a number of authors and learned Societies for kindly granting permission to copy a few specified illustrations and to take extracts from their published works. On these grounds I have specially to thank Dr Dubois and Mr G. T. Newton, F.R.S., for the large demands I have made on their

generosity. Other publications, which have supplied me with valuable materials, are duly acknowledged in the text or in the list of illustrations.

I have to thank the following Societies and publishers for lending me illustrations: The Geological Society, London (Figs. 60 and 61); the Royal Irish Academy (Figs. 45, 46, and 47); the Royal Society of Antiquaries of Ireland (Fig. 100); the Society of Antiquaries of Scotland (Figs. 25 to 32, 73, 74, 75, 102, 103, and 112 to 116); the Royal Society of Edinburgh (Fig. 57); Mr Chas. J. Clark, 4 Lincoln's Inn Fields (Figs. 105 to 109, 117 and 118; also Plates VI. and VII.); Dr Hans Hildebrand, on behalf of the authorities of the National Historical Museum, Stockholm (Figs. 110, 119 to 123, and 148); and the Anthropological Institute, London (Fig. 149, previously lent for the 'Lake-Dwellings of Europe').

ROBERT MUNRO.

48 MANOR PLACE, EDINBURGH,
9th April 1897.

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PART I.

ANTHROPOLOGICAL

PREHISTORIC PROBLEMS.

CHAPTER I.

INTRODUCTORY—RISE AND PROGRESS OF ANTHROPOLOGY.

Geology and Written Records—Early Discoveries—Collateral Influences—Range and Scope of Anthropology: (1) Ethnology, (2) Language, (3) Structure of Man, (4) Fossil Remains, (5) Handicraft, (6) Geology—Influence of the Supernatural—Methods of Classification—Progress of the new Science—Kent's Cavern—Belgian Caves—Archæological Activity in France—Reindeer Period—Sepulchral Caves—Distribution of Palæolithic Man—The *hiatus* between Palæolithic and Neolithic Civilisations in Europe—General Remarks.

EARLY in the present century geologists had fairly demonstrated that our globe had passed through a number of well-defined geological epochs, that living organisms, instead of having a recent origin, had been in existence countless ages ago, and that the present flora and fauna were sensibly different from those that preceded them. Though a general upward gradation in some of the forms of these organic remains, somewhat akin to the present classification of the animal and vegetable kingdoms, had been recognised by many, the scientific mind

could hardly grasp the idea that there had been a genetic connection between them. Geologists were rather inclined to the opinion that the world had passed through a series of destructive cataclysms, each of which had been succeeded by an entirely new series of plants and animals. These successive world-revolutions were supposed to be due to the direct interposition of an all-ruling Providence; and hence, for a time, geological speculations rather strengthened the so-called orthodox opinion that the present order of things was the final stage of the imaginary dramas of special creations, in which the creation of Man stood forth as the last and crowning achievement. But a fuller acquaintance with fossil remains soon rendered the theory of cataclysms untenable. In other words, the organic continuity of life throughout the successive geological periods was proved, and hence the creation of Man was for the time being forced into an exceptional position owing to the persistent prejudices of current opinions.

Looking at this problem from the standpoint of history and archæology, it is manifest that, however far back written records conduct us in an investigation of the early history of mankind, it can no longer be maintained that they cover more than a small portion of man's existence on the globe. That human racial characters were broadly marked, some 6000 years ago, has been surmised from an analysis of the ancient wall-paintings of Egypt. Thus, in the Tombs of the Kings at Thebes are to be seen, to this day, coloured and highly expressive portraits of the four principal races who then frequented the Nile valley; and it is a remarkable fact

that their distinguishing peculiarities, as depicted in the conventional eye and reddish-brown colour of the Egyptian, the fair-skinned and blue-eyed Libyan, the aquiline profile of the Semite, and the thick lip and curly hair of the Negro, are equally descriptive of their modern representatives. But if, during this long period, physical changes in these races have been so slight as to be almost inappreciable at the present time, what, it may be asked, must have been the duration of mankind in prehistoric times, whilst these persistent distinctions were being worked out under the influence of natural laws? From this point of view commemorative inscriptions, pictorial paintings, hieroglyphs, traditions, &c., lead us scarcely beyond the threshold of the dim vista which is made to converge in the remote past at a time when the ancestors of the white-, black-, and red-skinned people were one undivided stock. Similar deductions have been drawn from a study of the elements of speech, growth of culture, religious customs, and other deep-seated phenomena of human civilisation. Hence it has been argued that these general considerations alone furnish *prima facie* grounds for believing that, long before the rise of the earliest empires of antiquity, human characteristics had already been differentiated.

It was not, however, till a time to which the recollection of many now living extends that the scattered elements of Anthropology assumed sufficient coherence to be formulated into a science, and to give expression to a theory of man's origin more in accordance with observed facts than that which regarded him as the sudden product of a creative fiat. As time advances

the scientific discoveries, which gave rise to this important change of opinion, are apt to be forgotten in the midst of the engrossing social and intellectual problems which are daily springing up in the ever-widening field of human activity. Let me, therefore, very briefly bring to your recollection some of the more outstanding features of those discoveries, and of the intellectual upheaval which so speedily led to the recognition of Anthropology as an important branch of human knowledge.

Early Discoveries.

Prior to the publication of Sir Charles Lyell's work on 'The Geological Evidences of the Antiquity of Man,' isolated discoveries were recorded, from time to time, in different parts of Europe, disclosing facts which, in the opinion of a few savants, could only be accounted for by assigning to man a higher antiquity than was then the current opinion. These discoveries consisted, for the most part, of the remains of man—bones and industrial relics—associated with the bones of extinct animals, in undisturbed deposits of Quaternary times. The reception at first given to this class of evidence in scientific circles may be estimated from the following notes on a few of the earlier researches. As early as 1797 Mr John Frere, F.R.S., described to the Society of Antiquaries of London some flint "weapons," associated with the bones of extinct animals, found at a depth of about 12 feet in brick-earth at Hoxne, in Suffolk. He was so much struck with the situation that he gave a precise account of the circumstances, with sections

showing the stratified condition of the superincumbent strata; and he regarded the implements as belonging "to a very remote period indeed; even beyond that of the present world."[1] We are informed that Mr Frere presented some specimens of the Hoxne implements to the Museum of the Society, yet here they lay, unheeded and unsuggestive, till 1859, when Sir John Evans, on his return from Amiens and Abbeville, recognised them as similar to those in the collection of M. Boucher de Perthes.[2] Nor is this a solitary instance, for the same authority has directed attention to the discovery, at a still earlier date (about 1690), of a flint implement in association with an elephant's tooth in the gravel of Gray's Inn Lane. Though described in the Sloane Catalogue, and preserved in the British Museum, its significance became only known when Sir Wollaston Franks pointed out its identity with those found in the valley of the Somme.[3]

It was about the beginning of the second quarter of this century that Kent's Cavern, near Torquay, first became a subject of interest, owing to the researches of the Rev. J. MacEnery, who asserted that he found in it flint implements, associated with the bones and teeth of extinct animals, below a thick continuous sheet of stalagmite. But the legitimate inference from these facts — viz., that man was contemporary with these animals, and lived before the deposition of the stalagmite—had little chance of being accepted when opposed by the teaching and authority of so famous a geo-

[1] Archæologia, vol. xiii. p. 204.

[2] Ancient Stone Implements, &c., p. 517.

[3] Ibid., p. 521.

logist as Dr Buckland, author of the 'Reliquiæ Diluvianæ' and 'The Bridgewater Treatise on Geology and Mineralogy.'

The facts on which Mr MacEnery based his conclusions were verified by fresh excavations made by Mr Godwin-Austen, F.G.S., in 1840, and afterwards by a committee appointed by the Torquay Natural History Society in 1846. Papers embodying the results of these investigations were read at the Geological Society of London, and at the meeting of the British Association for 1847. But, according to the late Mr Pengelly, F.R.S., the reception given to these researches was not encouraging, and the inconvenient conclusions arrived at "were given to an apathetic, unbelieving world."[1]

Another discovery of a similar character was the Windmill-Hill Cavern, at Brixham, explored in 1858, under the auspices of a committee appointed by the Royal and Geological Societies of London. The first paper on the result of this investigation was read by Mr Pengelly in September 1858, at the meeting of the British Association then held at Leeds, in which it was announced that "eight flint tools had already been found in various parts of the cavern, all of them inosculating with bones of mammalia at depths varying from 9 to 42 inches in the cave-earth, on which lay a sheet of stalagmite from 3 to 8 inches thick, and having *within* it and *on* it relics of the lion, hyena, bear, mammoth, rhinoceros, and reindeer."

This paper, to use the phraseology of Mr Pengelly,

[1] See Literature of Kent's Cavern, by W. Pengelly—'Trans. of Devonsh. Assoc.,' and 'Reports of the Brit. Assoc.'

produced a decided "awakening," besides indirect results of the highest importance.

Analogous discoveries on the Continent had not fared much better. In 1829 Dr Schmerling commenced his memorable researches in the caverns of the province of Liége. The evidence of man's antiquity revealed by his investigations consisted of flint implements and the actual remains of human skeletons, among which was the famous Engis skull, associated with bones of the hyena, lion, rhinoceros, mammoth, reindeer, and cave-bear. This indefatigable explorer published an account of his discoveries in two splendid volumes, with an atlas of 74 plates (1833-34), in which, in the most unequivocal language, he contended for the contemporaneity of man with these extinct animals; but, owing chiefly to the influence of the doctrine taught by the great naturalist Cuvier, his opinions and arguments did not receive the attention they merited. Remains of man found in caverns were thus summarily disposed of by Cuvier: "On a fait grand bruit, il y a quelques mois, de certains fragments humains trouvés dans des cavernes à ossements de nos provinces méridionales, mais il suffit qu'ils aient été trouvés dans les cavernes pour qu'ils rentrent dans la règle." [1]

The discovery by M. Boucher de Perthes of rude flint implements, associated with bones of the mammoth and of other extinct animals, in the ancient gravel beds of the valley of the Somme, at various levels considerably above the present highest flood-marks of the river, equally failed to attract scientific

[1] Discours sur les Révolutions du Globe, p. 89.

attention. An account of his researches, under the title 'Antiquités Celtiques et Antédiluviennes,' was published in 1847, but for upwards of ten years it lay absolutely unheeded. Nor can there be any doubt that the ultimate recognition of the importance of his discoveries was one of the indirect results of the less sceptical tone prevalent in scientific circles in Britain in consequence of the exploration of the Brixham cavern previously referred to.

Sir John Evans, who took an active part in the exciting events of those days, writing in 1872, makes the following remarks on this transitional period:—

> In the autumn of 1858, however, the late distinguished palæontologist, Dr Hugh Falconer, F.R.S., visited Abbeville, in order to see M. Boucher de Perthes' collection, and became satisfied that there was a great deal of fair presumptive evidence in favour of many of his speculations regarding the remote antiquity of these industrial objects, and their association with animals now extinct. Acting on Dr Falconer's suggestion, Mr Prestwich, F.R.S., whose researches have been so extensive and accurate as to place him in the first rank of English geologists, in April 1859 visited Abbeville and Amiens; where I, on his invitation, had the good fortune to join him. We examined the local collections of flint implements, and the beds in which they were said to have been found; and, in addition to being perfectly satisfied with the evidence adduced as to the value of the discoveries, we had the crowning satisfaction of seeing one of the worked flints *in situ*, in its undisturbed matrix of gravel, at a depth of 17 feet from the original surface of the ground.[1]

That it was through the intervention of English savants that M. Boucher de Perthes' discoveries were

[1] Ancient Stone Implements, &c., p. 478.

rescued from obscurity is thus acknowleged by M. Gabriel de Mortillet :—

"Après des efforts obstinés et de nombreuses luttes, il eut enfin la satisfaction d'entendre, avant sa mort, tous ses contemporains lui rendre justice. Ce fut surtout à l'intervention, en 1859, de savants anglais, MM. Joseph Prestwich et John Evans, que le savant français dut de voir sa découverte généralement admise." [1]

A few years prior to 1859 Dr Falconer raised a presumption in favour of the view that man was contemporary with the extinct quaternary fauna from finding charcoal and flint flakes in the bone-caves of Sicily (*San Ciro*, *Maccagnone*, and others), associated with osseous remains of lion, spotted hyena, *Elephas antiquus*, hippopotamus, grizzly bear, &c.[2]

Collateral Influences.

Interest in these novel speculations became now greatly enhanced in consequence of equally important and far-reaching discoveries in the collateral sciences. The entire borderland of geology and anthropology was being better understood, especially as regards the remarkable glacial phenomena of quaternary times in northern and western Europe; and archæology proper, independently of its new-born palæolithic phase, had acquired a wider significance, owing to the more rigid and scientific methods adopted in its study. The Scandinavian savants, despairing of being ever able

[1] Le Préhistorique, p. 14. [2] Palæontographical Memoirs, vol. ii. p. 543.

to elucidate the early history of their country by means of the ancient Sagas and other traditionary sources, were now subjecting the archaic remains, so profusely scattered over the country, to the most crucial tests which scientific ingenuity could devise. All departments of knowledge—geology, hydrography, conchology, zoology, botany, and ethnology — were enlisted in this national work. In this manner, and with such resources, they examined peat mosses, graves, megalithic monuments, refuse heaps, and, in short, everything that was likely to throw light on the culture and civilisation of the prehistoric people of their country. Early in the century a novel system of classifying relics was adopted by MM. Thomsen and Worsäe in Denmark, and by MM. Sven Nilsson and Hildebrand in Sweden. This system involved a certain chronological sequence in the introduction of metals, together with the recognition that, long before this, there existed in Scandinavia an organised population who managed to attain to a high degree of civilisation with no better implements and tools than could be manufactured out of stone, horn, bone, &c. The successive discoveries of Køkkenmøddings in Denmark and Lake-dwellings in Switzerland, with the vast and varied wealth of prehistoric materials which they disclosed, now also began to attract universal attention.

While these problems and numerous side issues were being discussed, the scientific world was startled in 1859 by the publication of Charles Darwin's 'Origin of Species.' In this work the author advocated, with singular completeness and ability, that the various

species of plants and animals now extant, and being continued by the ordinary laws of generation, had been derived from pre-existing forms by secondary causes—a process which he designated under the name of *Natural Selection*. The key to this theory is to be found in the severe struggle for existence which all organisms have to maintain, not only against their natural enemies, but against the overcrowding of their own species. The outcome of a contest under conditions where it is only possible for a limited number to find the means of subsistence, is the survival of the fittest and the extinction of the weakest. In this manner Mr Darwin traced the origin of Man through a series of intermediate forms back to protoplasm, without the intervention of repeated cataclysms and special creative dramas, as was generally held by the earlier geologists. "As all the living forms of life," he writes, "are the lineal descendants of those which lived long before the Cambrian epoch, we may feel certain that the ordinary succession of generation has never once been broken, and that no cataclysm has desolated the whole world."[1]

Like all great discoveries, the grandeur of Mr Darwin's conception lay in the simplicity and transparency of its truth; and as a small particle leavens the mass, so the words "struggle for existence" and "survival of the fittest" set the whole philosophical world into a ferment. Indeed, it is impossible to exaggerate the profound effect produced on his fellow-men by the doctrine thus taught by Mr Darwin. Many of the greatest naturalists of the day at once discarded their former

[1] Origin of Species, p. 428.

creeds and adopted the evolution theory of life; and, at the present time, it may be well asked who and where are its opponents? Evolution was then by no means a new idea, but hitherto no naturalist had formulated a *modus operandi* of its laws. Lamarck believed in the development of the higher animals, but he adduced no evidence in support of his belief beyond the vaguest hypotheses. But, whatever these may have been, it cannot be denied that he unequivocally propounded the theory of "Variation of Species" as a consequence of changes in the environments. On the other hand, Cuvier, who had the amplest evidence daily before his eyes, was so blinded by his preconceived notions that he failed to take advantage of the strange palæontological materials among which he worked.

Foremost among the galaxy of eminent men who took part in the exciting controversies which the 'Origin of Species' gave rise to was the celebrated geologist, Sir Charles Lyell, whose work on the Antiquity of Man greatly helped to consolidate the doctrines of anthropology. In this work the author collected the previously recorded materials bearing on the early history of man from all parts of the world. The effect of its accumulated details was so overwhelming that there could no longer be any doubt that the existence of humanity on the globe must be relegated far back into the Quaternary period. With the general acceptance of the doctrine of evolution and man's great antiquity terminates, what may be called, the struggling period of anthropology.

Range and Scope of Anthropology.

As already remarked, it was the coalescence of the greatly extended power of deciphering unwritten records with the almost coincident teaching of Darwin which first enabled the antiquary to look beyond the horizon of historic vision, and so to discover materials for a science of anthropology. So long as it was maintained that man had been ushered on the arena of life specially equipped, morphologically and teleologically, for the struggle of existence, there was no room for such a science, as its range would be necessarily restricted to the operations and modifications of mankind during the last five or six thousand years — a field already sufficiently covered by the ordinary historical methods of research. From the new standpoint, anthropology has a much wider scope, and embraces the origin, development, and civilisation of mankind. Its object is to trace the career of man through space and time, amidst the vicissitudes of his ever-changing environments, during the ages which have elapsed since he first diverged from his quadrupedal congeners. During this long period there were many influences at work, all of which have to be carefully noted; the causes which led to the physical and mental endowments which gradually transformed him from *Animal brutum* to *Homo sapiens;* the methods and processes by which he discovered and utilised the forces of nature, and constructed a system of civilisation on the principles of intelligence; and finally, the means by which he learned to distinguish between good and evil,

in consequence of which he became a responsible being, and laid the foundations of a science of conscience and ethics.

To analyse and systematise the evidences on which these momentous issues are based is the special province of anthropology. Whatever opinion may be formed as to the adequacy of the argumentative materials already collected in support of the conclusions arrived at, one thing is certain, that they cannot be ignored. They are culled from the widest possible range of mental and physical phenomena, and are rapidly accumulating. On the present occasion it will be sufficient for my purpose to take a bird's-eye view of them under the following heads:—(1) Ethnology, (2) Language, (3) Structural relationship of Man with other living Organisms, (4) Fossil Remains of Man, (5) Handicraft Products of Man, (6) and lastly, The bearing of Geology on the Prehistoric Remains of Man.

I do not propose to discuss here the amount and respective values of the materials so classified, but merely to give a few illustrative examples of the manner in which they are brought together through these different channels, and made to fit complementary niches in the construction of the science of anthropology.

1. Ethnology.

In regard to ethnology, it is almost unnecessary to say anything. The geographical distribution of the various races of man, the physical peculiarities of the bodies and features,—the conformation of the skull, the

size and structure of the brain, the colour of the skin, eyes, and hair,—together with the products of different civilisations scattered over the globe,—are amongst the most essential elements which enter into this science. At the present time, indeed, great prominence is given to the collection and assortment of such ethnological materials brought by travellers from all parts of the world.

2. Language.

Knowledge may be communicated from one individual to another by gestures, sounds, pictures, and characters or letters representing definite ideas, according to a prearranged system; and it belongs to the science of anthropology to trace the growth of all these methods from their primary sources. The value of language when transmitted by books and inscribed stones, such as the hieroglyphic and pictorial monuments of Egypt and the cuneiform tablets of Assyria and Babylonia, is so apparent that I need not dwell on this phase of the subject. On the other hand, spoken language is too transient to be reckoned of much consequence in determining the racial distinctions of mankind. The geographical distribution of a language does not always coincide with that of the people who invented it; and, indeed, a given speech may altogether cease to be a living means of intercommunication, while the descendants of its original inventors continue to flourish under one borrowed from a different race. The fact that the Celtic language, which formerly prevailed over a large area in Western Europe, is now only to be found in one

or two isolated corners, lends no support to the theory that a similar fate has overtaken the people who first introduced it. If we look underneath the superficial crust of modern civilisation, even in the most Saxonised part of England, we find the change of speech to be in many instances merely a gloss over the more persistent racial characters of a former people. *Cælum non animum mutant, qui trans mare currunt.* It is indeed seldom that the most evanescent peculiarities of a people disappear altogether without leaving some traces behind them: even the fragments of a vanished language, when carefully looked for, will be found fossilised in the names of the outstanding features of the country—its mountains, valleys, rivers, lochs, forests, &c. But it is the results obtained through recent methods of palæo-linguistic research that more especially interest us as anthropologists. These results may be better illustrated by a well-known example. A glance at the structural elements of Italian, French, and Spanish is sufficient to show that these languages are direct descendants of Latin; and had this language been absolutely lost, modern philologists could, to a large extent, have reconstructed it. By the application of their analytic methods to the inscribed materials dug out of the ruins of proto-historic monuments, philologists have been able to extend this field of research far back into prehistoric times. They have most conclusively shown that the so-called Indo-European languages, comprising Old Celtic, Latin, Greek, Gothic, Old Russian, Old Persian, Sanskrit, &c., have descended from one common stock. The existence of this parent-language,

however far back it may be removed from its varied offspring, necessarily implies a people who spoke it; but who these primitive Aryans were, where they lived, and whence they came, are amongst the most controverted problems of the present day. Similarly, these linguistic archæologists are now successfully pushing their investigations into the Accadian or pre-Semitic period, which underlies the civilisations of Assyria and Babylon.

3. Structure of Man.

The striking correspondence between the bodily structure of man and that of some of the higher animals, such as the anthropoid apes, could hardly have escaped the attention of reflective man in later ages; and I have no doubt that long before Huxley published his work on 'Man's Place in Nature,' vague ideas of this kind had flitted across the brain of many a bygone philosopher. But all these premonitory glimmerings of the truth would be probably smothered, as it were in embryo, by the overpowering influence of prejudices founded on other issues. It is thus referred to by Darwin: "It is notorious that man is constructed on the same general type or model as other animals. All the bones in his skeleton can be compared with corresponding bones in a monkey, bat, or seal; so it is with his muscles, nerves, blood-vessels, and internal viscera. The brain, the most important of all the organs, follows the same law, as shown by Huxley and other anatomists. Bischoff, who is a hostile witness, admits that every chief fissure and fold in the brain of man has its

analogy in that of the orang; but he adds that at no period of development do their brains perfectly agree; nor could perfect agreement be expected, for otherwise their mental powers would have been the same."[1] This correspondence becomes still more apparent when we examine the phenomena of the fœtal life of animals. Not only does the human embryo start from an ovule similar to, and indistinguishable from, that of other mammals, but its subsequent changes follow on precisely the same lines. Moreover, all the homologous organs in the full-grown animals, as the wing of a bird, the flipper of a seal, and the hand of man, are developed from the same fundamental forms. "Without question," says Professor Huxley, "the mode of origin and the early stages of the development of man are identical with those of the animals immediately below him in the scale."[2]

The illustrious Von Baer, who first directed special attention to embryology, formulated a law to the effect that the structural differentiation in fœtal development was from a general to a special type. Haeckel, looking at the same phenomena from a different standpoint, came to the conclusion that the development of the individual is a recapitulation of the historic evolution of the race. This is a most astounding statement; and, if true, the study of embryology should supply the anthropologist with a much shorter way to the goal of his inquiry—a way by which the progressive phases of man's corporeal structure would be reduced to the compass of an experimental illustration within

[1] Descent of Man, p. 6.

[2] Collected Essays, vol. vii. p. 89.

the precincts of the laboratory. Not being a practical physiologist, I am unable to determine the precise value to be assigned to this analogy between the two evolutions, but, on other grounds, I should say that it is true only in a very general way. If embryology is as conservative of energy as other organic processes, I would expect that some minor links would have dropped out altogether in passing to higher results. Nature's operations are full of short cuts. As a parallel case, let me cite the instinct which makes a bee fix on a hexagonal cell, or which leads a bird to migrate in winter, both of which must be regarded as originally acquired through the ordinary means of natural selection, but which ultimately have become transmitted directly through heredity, altogether independent of their earlier evolutionary stages.

Another fertile source of arguments in support of the theory of man's descent from the lower animals is to be found in the rudimentary organs described by anatomists as normally present, or occasionally to be met with, in man. Such organs as canine teeth, the coccyx, the inter- and supra-condyloid foramina of the humerus, the appendix vermiformis, remnants of some muscles, &c., &c., are apparently useless in the human economy, but their homologues in other animals have special functions assigned to them. But, indeed, the homological structure of the entire human body is utterly inexplicable on any other hypothesis.

"Thus we can understand," to quote Darwin's words once more, "how it has come to pass that man and all other vertebrate animals have been constructed on

the same general model, why they pass through the same early stages of development, and why they retain certain rudiments in common. Consequently we ought frankly to admit their community of descent; to take any other view is to admit that our own structure, and that of all the animals around us, is a mere snare laid to entrap our judgment. . . . It is only our natural prejudice, and that arrogance which made our forefathers declare that they were descended from demi-gods, which leads us to demur to this conclusion. But the time will before long come when it will be thought wonderful that naturalists, who were well acquainted with the comparative structure and development of man and other animals, should have believed that each was the work of a separate act of creation."[1]

4. Fossil Remains of Man.

The difficulty of assigning a definite age to the osseous remains of ancient man which have hitherto come to light, owing partly to their fragmentary condition, and partly to imperfect observations as to their exact stratigraphical position, gives to this class of evidence a tinge of uncertainty. Hence such materials are more liable to the attacks of opponents; but after all deductions are made on the plea of "not proven," there remains a residuum of irrefragable data which so far support the theory of evolution as applied to Man. While no part of the skeleton is without some measure of determinative value, the skull is of special impor-

[1] Descent of Man, p. 25.

tance, because it is of itself sufficient to supply the principal elements of the distinction between the human races. Between forty and fifty human skulls, more or less intact, and supposed to date back to Quaternary times, have been found in almost as many different localities throughout Europe, occasionally in alluvial deposits, but more frequently in the accumulated *débris* of caves and rock-shelters. Some years ago MM. de Quatrefages and Hamy carefully examined all the fossil remains of the quaternary population of Europe then known, and classified them under the names of the localities where the most typical specimens were found. Among dolichocephalic, or long-headed, they recognised two distinct races, one represented by a skull found at Canstadt, near Stuttgart, and the other by a skull from the rock-shelter of Cromagnon, in the Dordogne district. The brachycephalic, or broad-headed, are made to represent four races, under the generic designation of Furfooz, the name of a cave in the valley of the Lesse, in Belgium. (See *Crania Ethnica.*)

I. Dolichocephalic	1. The race of Canstadt, cephalic index	72
	2. The race of Cromagnon, " .	73·76
II. Brachycephalic	1st Furfooz, cephalic index . .	79·31
	2d Furfooz, " . . .	81·39
	Grenelle, " . . .	83·53
	La Truchère, " . . .	84·32

Under this fanciful nomenclature all the supposed quaternary skulls collected to date were classified, each in accordance with the type to which its osteological characters most nearly conformed. Thus, under the so-called Canstadt race, we have a number of well-known skulls, such as that famous specimen from the

Neanderthal cave, near Dusseldorf, that of "the fossil man of Denise," and others from widely separated localities, as Eguisheim in the upper Rhine district, Brux in Bohemia, Olmo in the valley of the Arno, near Florence, &c. This type of skull is characterised by being extremely dolichocephalic, and having a low retreating forehead and very prominent superciliary ridges. On extending the area of observation, it soon became apparent that this form of skull was not confined to the Quaternary period, but occupied, in subsequent ages, even a wider geographical distribution. It has been found not only in caves but in the dolmens, Gallo-Roman cemeteries, and various tombs, both ancient and modern, from Scandinavia to Spain, and from Iceland to the Crimea and other parts of Russia. Nay, more, men with heads of the Canstadt type may be seen stalking among the present day philosophers. Let me just quote the following remarks by M. de Quatrefages on this point:—

"At the Paris Congress, M. Vogt quoted the example of one of his friends, Dr Emmayer, whose cranium exactly recalls that of Neanderthal, and who is nevertheless a highly distinguished lunacy doctor. In passing through the Copenhagen Museum, I was struck by the Neanderthal characters presented by one of the crania in the collection: it proved to be that of Kay Lykke, a Danish gentleman, who played some part in the political affairs of the seventeenth century. M. Godron has published the drawing of the skull of Saint Mansuy, Bishop of Toul in the fourth century, and his head even exaggerates some of the most striking features of the

Neanderthal cranium. The forehead is still more receding, the vault more depressed, and the head so long that the cephalic index is 69·41. Lastly, the skull of Bruce, the Scotch hero, is also a reproduction of the Canstadt type."[1]

The Cromagnon and Furfooz types have an equally wide distribution in space. With such diversity in the osteological characters of fossil crania, it is clear that the scientific value of the evidence they are capable of furnishing can only be correctly interpreted when supplemented by collateral sources of investigation. The mere measurement of skulls seems only to prove that the earliest population of Europe showed as great a mixture and diversity of races as are to be found at the present day. (See Chap. iii.)

5. The Handicraft Products of Man.

Under this heading we have to deal with a class of evidence unique in nature, and exclusively applicable to man, as the only known toolmaker in the world. Although many of the other animals are superior to him in bodily strength, and are possessed of acuter senses, yet he has succeeded in gaining the mastery over them all by the simple invention of manufacturing implements and weapons. Since he attained this art he has, to a certain extent, divested himself of the means of attack and defence with which nature originally endowed him, and substituted, instead of them, a system of armour founded upon practices and methods never

[1] The Human Species, p. 309.

before used by any other being in the history of the organic world. In swimming, flying, running, &c., man is nowhere among thousands of competitors; yet he outstrips them all in the actual attainment of locomotion by sea or land. Whenever an enemy becomes unmasked, it is sure to succumb eventually to his artifices. The bigger and stronger the antagonist, the more readily does he fall a prey to his cunning and ingenuity. After extinguishing the great giants of the antediluvian world, it would appear that at the present time his greatest opponents are micro-organisms, which, in the form of parasitic germs, establish themselves as colonies in his own body, where they consume his very vitals, and in this way bring about his downfall. But he is on their track; and, as we are told that the resources of civilisation are not yet exhausted, it is to be hoped that these will soon be reckoned also among his beaten foes. One great characteristic of man's handiworks is that they bear the impress of intelligence. Hence a specimen of his workmanship, whatever its age, always conveys to the critical eye some knowledge of the technical skill and mental qualities of its maker. Wherever such objects are found, and to whatever period they may belong, it follows to a certainty that their manufacturers were there also. On the assumption that the reasoning power, and its counterpart the manipulative skill of man, were feeble at first, but improved gradually, we naturally expect that stray objects left behind him would disclose, at successive stages, indications of his upward progress. This induction—now amply proved by practical research—is the magic

key by which the long-hidden secrets of prehistoric man are being unlocked. In short, we have in these handicraft works—implements, weapons, ornaments, temples, tombs, houses, &c.—a graduated scale of man's progressive civilisation and career on the globe. To this generalisation exception may be taken on the ground that we occasionally find evidence of degeneration in the products of some districts. But these are local and necessary incidents of the competition between rival races. Worked objects of stone, horn, wood, or metal, when met with in stratified deposits, serve a similar purpose in anthropology that fossils do in geology. Let me here observe, however, that although man is the only being who has acquired and developed the power of fashioning, from the raw material, tools and instruments, by means of which he has so largely altered the surface of the globe, and utilised the forces and products of nature in the furtherance of his own civilisation, he is not alone in the knowledge and application of mechanical contrivances. Many other animals possess, in a minor degree, the power of adapting means to special ends. Results of this principle may be seen in the construction of the dam of the beaver, the nest of the bird, and the cell of the bee. But from all such productions human workmanship is broadly defined by the fact that it involves the use of artificial tools.

One other characteristic feature of man's methods may be noticed. Although fire, in the form of lightning, volcanoes, conflagrations, &c., must have been a conspicuous phenomenon ever since organic life appeared on the globe, he alone has taken advantage of

its properties to improve his condition of life. So indispensable to human civilisation has the agency of fire been regarded that the earliest traditions assign its origin to Heaven, whence Prometheus is said to have stolen it in a hollow tube. Hence the presence of charcoal in circumstances which preclude its production or importation by cosmical causes — as, for example, when it is met with in the *débris* of a cave—would be legitimate evidence of the contemporaneity of man.

6. Geology.

The sciences of geology and anthropology may be said to join hands in the Post-Pliocene or Quaternary period, where the chief problems and phenomena to be investigated are common to both. Between the two departments there lies a neutral territory, in which their respective materials overlap and interdigitate in a most remarkable manner. The geologist's chief object is to interpret the life-history of the period; and here, for the first time, he encounters positive evidence of the existence of man.

The exceptional combination of climatal conditions which culminated in the glacial period is another strange phenomenon which the geologist is especially called upon to explain; but, notwithstanding this, it also occupies a prominent place on the field of anthropology, as I believe that among the causes which led to the differentiation of the primary racial distinctions of man from his tertiary congeners, this Ice age, with its concomitant alteration in climate, will be found to have

been an important factor. The gradual interposition of such a huge mass of ice over a large portion of Europe—thus changing a subtropical climate to one of arctic severity — was followed by representatives of the flora and fauna of northern regions; and hence it would appear that a wide zone in Central Europe became a common habitat for two distinct faunas, one hailing from the north and the other from the south. It is difficult to account for the precise conditions which led to the intermingling of such different species as the mammoth, rhinoceros, Irish elk, cave-bear, cave-tiger, hyena, reindeer, hippopotamus, horse, &c. But whatever may have been the true explanation, whether interglacial genial periods, or great extremes of temperature in the summers and winters, or any other cause, it is certain that a succession, or successions, of such climatal alterations taxed the life-capacity and power of endurance of these animals to a degree which ultimately became unbearable. Now they are almost all gone from those localities. A number of them have become extinct, and others are still represented in more congenial climates, according as they possessed northern or southern proclivities. Man was the contemporary of them all, and he is the only conspicuous animal which successfully battled against these intensely adverse circumstances. Man has emerged from this singular contest, still bearing traces of the means to which he resorted in the struggle for life. An upright posture, a manipulative hand, and a highly reflective brain are trophies of which he may be justly proud; but, like scars, they tell a

tale of many battles. The history of these departed mammals, among which Man in his youthful days lived, moved, and had his being, throws much light on the ways and methods by which he accommodated himself to the exigencies of the climatal instability which obtained in Quaternary times.

But, besides these common interests, the anthropologist is largely dependent on the geologist for explanatory details of the phenomena with which he has to deal, such as the position and chronological sequence of river gravels, sea beaches, aqueous deposits, peat beds, the formation and filling up of caves, &c., in all of which relics of man are most commonly met with. The nature of the matrix in which a worked object is found, its depth below the surface, the composition and disposition of the superincumbent *débris*, &c., are also problems to be decided by geological skill.

On the borderland of physical science other issues also fall to be determined by collateral evidence: for example, a most legitimate inference from such a discovery as the skeleton of a reindeer with a stone axe embedded in its skull would be that this animal and man were contemporary. If the supposed discovery were in Lapland, where the reindeer still lives, its archæological value would be almost *nil;* on the other hand, if it had been in one of the Dordogne caves, it would reveal an important fact—viz., that man lived at a time when the climate in that part of France had been so cold as to permit of the growth of the plants and lichens which form the natural food-supply of the reindeer.

Influence of the Supernatural.

The tendency to assign strange and unaccountable phenomena to supernatural causes appears to have been a feature common to humanity in all past civilisations. To this category were relegated, in early historical times, many of the industrial products of the previous and less civilised races. The Greeks and Romans took particular notice of the polished stone hatchets which were then, as now, occasionally picked up in the fields and other odd places. Unable to account for their production on any other hypothesis, they regarded them as thunderbolts (*ceraunia*), and professed to find them wherever lightning was seen to strike the earth; hence they came to be used as charms and talismans, to which extraordinary virtues were attributed. Some variant of the popular belief, so long prevalent in this country, that flint arrow-heads were the missiles of elves or fairies, was widely spread throughout the world. Equally persistent and widespread was the idea that these stone objects were possessed of the property of healing diseases and averting threatened calamities, such as the evil-eye and other imaginary ills. Dr Bellucci, of Perugia, in his well-known 'Catalogue of Italian Amulets,' has tabulated, under the heading *Pierres de foudre*, twenty arrow-heads and thirty stone axes which had been used as charms throughout the country. Among the curiosities imported into Europe, after the geographical discoveries of the fifteenth century had opened up the New World to research, were stone implements, such as axes, chisels, arrow-

points, knives, &c., found actually in use among various primitive people. This was the first clue to the true function of the so-called *Ceraunia* and *Pierres de foudre* of the ancients. In 1723 we find Jussieu suggesting, at the Academie des Sciences, that the *Pierres de foudre* were the implements of a savage people who lived in Europe in earlier times. But it remained for the new-born science of anthropology to give the *coup de grâce* to this kind of superstition.

Another of its more immediate results was a complete explanation of the curious custom which preserved the use of stone weapons in religious ceremonies, long after the discovery of metals had superseded them in the ordinary affairs of life. For example, in the Egyptian process of embalming, the first incision on the body was made with a knife of Ethiopian stone, no doubt flint, as many such implements, supposed to have been used for this purpose, have been found in the tombs and elsewhere throughout the country. The Jews used stone knives for performing the ceremony of circumcision; and also the priests of Baal when, as on the occasion of high festivals, they hacked their persons in order to ingratiate themselves with their god. It was a flint knife that Hannibal used when he sacrificed a lamb before he gave battle to Scipio on the banks of the Ticino. Underlying this religious conservatism was the fact, which ultimately gave a sacred character to these implements, that they were survivals of an age when metals were entirely unknown. This ceremonious retention of them to later ages may be paralleled by the present-day custom of placing an urn on the top of a sepulchral monument.

Methods of Classification.

The light thrown upon the past by the correct interpretation of these worked stone objects, and the recognition of the ruder flint implements as the work of man, opened up a novel field of research. The work of collecting and classifying specimens has progressed steadily ever since, and there is now at the disposal of archæologists a vast amount of such material. The principle of classifying stone implements into Palæolithic and Neolithic, first suggested by Sir John Lubbock, depends to a large extent on whether they are roughly chippped or polished. The idea is that before man recognised or acquired the art of giving a sharp edge to his cutting tools, he went on for ages manufacturing them by the rough and ready process of chipping. But, of course, it does not follow that chipping was henceforth abandoned, as it still was a stage in the manufacture of the more perfect implement. However trivial the new art of polishing may at first sight appear, it really marks an important stage in the progress of civilisation.

In the workmanship of palæolithic objects various degrees of skill are detected, which may be traced in descending order to the state when it becomes difficult to say whether we are dealing with the handicraft products of man or not. They have indeed disclosed to the eye of the expert so many distinct phases as regards form, size, manner of chipping, and patina or surface lustre, that their classification is by no means an easy

task. French anthropologists divide them into four divisions, representing as many progressive epochs, under the names of the localities which have yielded the most characteristic specimens—viz., Chelléen, Moustérien, Solutréen, and Magdalénien. But the special *technique* in their manufacture, though clearly showing a progressive skill, is of little value in deciding the question of their antiquity, as it might have been acquired in a few centuries instead of hundreds of centuries. Hence, in order to assign a more definite meaning to the duration of the series of changes disclosed in this chronological sequence, the anthropologist has recourse to collateral sources of information. And this is one of the points in which the geologist comes so opportunely to his assistance. The latter, without taking cognisance of the objects themselves, examines the gravel beds, or other localities, in which they were found, and ascertains, on geological grounds alone, their relative antiquity. Here, he comes to a bed of ancient river-drift, left high and dry, many feet above the present highest flood-mark of the river; there, but still higher up the slope, another similar bed, both of which yield flint implements. These two gravel deposits are, of course, of different ages; and so the geologist also comes to form a chronological scale based on the length of time the water has taken to excavate the valley. This is how Sir John Evans depicts the chronological element involved in this problem:—

Taking our stand on the high terraces at Ealing, or Acton, or Highbury, and looking over the broad valley, four miles in

width, with the river flowing through it at a depth of about 100 feet below its former bed, in which, beneath our feet, are relics of human art deposited at the same time as the gravels, which of us can picture to himself the lapse of time represented by the excavation of a valley on such a scale by a river greater, perhaps, in volume than the Thames, but still draining only the same tract of country?

But when we remember that the traditions of the mighty and historic city now extending across the valley do not carry us back even to the close of that period of many centuries when a bronze-using people occupied this island; when we bear in mind that beyond that period lies another of probably far longer duration, when our barbaric predecessors sometimes polished their stone implements, but were still unacquainted with the use of metallic tools; when to the Historic, Bronze, and Neolithic Ages we mentally add that long series of years which must have been required for the old fauna, with the mammoth and rhinoceros, and other, to us, strange and unaccustomed forms, to be supplanted by a group of animals more closely resembling those of the present day; and when, remembering all this, we realise the fact that all these vast periods of years have intervened since the completion of the excavation of the valley and the close of the Palæolithic Period, the mind is almost lost in amazement at the vista of antiquity displayed.[1]

As already mentioned, the contents of caves sometimes afford the means of estimating the relative sequence of events during quaternary and recent times. As an illustration, we may again refer to the singularly suggestive phenomena disclosed by the now completed excavation of Kent's Cavern. No investigation has ever been conducted under more qualified auspices, nor with greater care, than the excavation of this cave; and, consequently, the results are correspond-

[1] Ancient Stone Implements, &c., p. 622.

ingly valuable. Briefly stated, the following deposits were uniformly met with from above downwards :—

(1) Black mould, 3 to 12 inches thick.

(2) A layer of granular stalagmite, 1 to 3 feet thick.

(3) Cave earth, of variable depth.

Upon examining these three deposits, it was found that the upper contained relics of modern man associated with a fauna essentially the same as that of the present day, and representing a period of at least 2000 years. The bed of stalagmite, which contained few relics of any kind, formed a complete partition between the two deposits above and below it, and virtually separated the remains of two totally distinct civilisations. The contents of the cave-earth below it included implements and tools of flint and bone, shells of pectens, ashes, and charcoal, together with the broken bones of a variety of animals. But not only were these worked objects of palæolithic types, but the bones represented, for the most part, an altogether different fauna. Not a bone of the ox, sheep, goat, pig, dog, &c., animals whose remains were exclusively encountered in the deposits above the stalagmite; but instead of them there were the bones of the cave-lion, cave-hyena, mammoth, woolly rhinoceros, wild bull, Irish elk, reindeer, grizzly bear, wild-cat, horse, beaver, &c.

These records give us some strange glimpses of past humanity in the south of England. They prove that palæolithic man frequented this cavern as a hunter of the great extinct mammals which formerly roamed over the country. Then, for some reason or other, probably

of a climatal nature, came the Stalagmitic period, during which the cave was seldom frequented by man or animals. How long this continued it is impossible to say; but when the conditions which induced it passed away, man and the contemporary animals again resorted for shelter to its gloomy recesses. During the deposition of the stalagmite, the records of the cavern are almost silent as to what was going on outside. When they become again decipherable, how different is the tale they tell. Everything, man and beast, is changed! Were palæolithic man to reappear on the scene, he would hardly recognise his own kindred amidst the luxuries of the Bronze age. But the greatest and saddest change to him would be in the animal world; and with the disappearance of the mammoth, the great Irish elk, and other big game with which he was familiar, he would probably think that life was not worth living in such degenerate days.

Progress of the New Science.

In the preceding remarks I have briefly described a few of the scientific facts and speculations which loomed on the philosophical horizon when the theory of the natural development of Man was first promulgated, together with some illustrations of the nature and sources of the evidence on which it was founded. I now proceed to inquire what progress this theory has made, and what additional evidence has been advanced for or against it since the publication of Sir Charles Lyell's work on the Antiquity of Man, which, it will

be remembered, terminated what was characterised as the struggling period of Anthropology. That book was issued on the 6th February 1863, and before the expiry of the year no less than three editions were called for, a fact which sufficiently shows the avidity with which its doctrines were received. This success was, no doubt, partly due to the marvellous ability of the eminent author in generalising and popularising his facts, but partly to the extreme tension on the philosophic mind which by this time had become so much unhinged as to be on the *qui vive* for such an *exposé*. The result was a complete victory for scientific truth and its novel methods of research.

Henceforth, a new impetus was given to the study of this science by the conviction that the meanest traces of man's early career were actually more important materials for a history of humanity and civilisation than all the treasures that had been collected from the ruins of the greatest empires of the historic world. The wide morphological gap between man and the other animals still living suggested a correspondingly long period for his development, in the course of which it was expected that some evidence of the stages through which he had passed might have become stereotyped in the geological records. Where to find, and how to interpret, these records were now the chief problems at issue; and to their solution the savants of all countries braced themselves with an energy that augured final success. Societies were founded in London, Paris, and other centres of intellectuality, for the express purpose of following up the new-found trail of humanity; and to

popularise and disseminate their doctrines, numerous periodicals and special works were published. One periodical may be specially mentioned—viz., 'Les Matériaux pour l'histoire primitive et naturelle de l'homme'—which, since it was started by G. de Mortillet in 1864, has been the means of giving wide publicity to the new doctrines. In the year 1865, at a special meeting of the Italian Society of Natural Science held at Spezzia, was founded the "Congrès International d'Anthropologie et d'Archéologie Préhistoriques," the first meeting of which was held in the following year at Neuchâtel. Subsequent meetings have been held at Paris (1867), London (Norwich, 1868), Copenhagen (1869), Bologna (1871), Brussels (1872), Stockholm (1874), Buda-Pesth (1876), Lisbon (1880), Paris (1889), and Moscow (1892). The published proceedings of these congresses contain the most complete records of the progress of the science, especially as regards Europe. After the cloud of scepticism which enveloped its early and evolutionary stages had been swept aside, Anthropology found a footing at the British Association, at first as a sectional department, but since 1884 it became expedient to devote a special section for the exclusive consideration of its doctrines.

Exploration of Kent's Cavern.

One of the greatest achievements in Britain has been the complete exploration of Kent's Cavern, under the superintendence of Mr Pengelly and a scientific committee of the British Association. The investigation

was begun on the 28th March 1865, and continued without interruption to the 19th June 1880, at an expense of £1963.[1] Having already twice referred to facts disclosed in the course of the investigation of this cavern, only a few words remain to be said on the relative age of the human relics found in the cave-earth. These consist of objects made of stone and bone or horn. Among the former are tongue-shaped, ovoid, and triangular tools of flint, together with worked flakes, scrapers, and cores of the same material; also a few hammerstones, one of sandstone being shaped like a cheese. Of bone there are pins, awls, barbed harpoons, and a neatly formed needle. From the style of workmanship of these objects, especially the harpoons and needle, there can be little doubt that they belong to the same age as the Reindeer period of France—*i.e.*, to the end of the Quaternary period—an opinion thus expressed by so competent an authority as Sir John Evans:—

In attempting to correlate the works of man from Kent's Cavern with those from the French caves, we find that the harpoons and needle belong to the age of La Madeleine, though bones engraved with pictorial designs—which are also characteristic of that period—are wanting. Some of the flint implements, however, approximate more closely in character with those of the age of Le Moustier and Aurignac; while the age of Laugerie Haute is not decidedly represented by any of its peculiar forms. If any value attaches to these analogies, there would seem to be reason, on these grounds also, for supposing that the infilling of the cave with the red earth was the work of a long lapse of time. The black band, which

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[1] British Association Report, 1883, p. 556.

in part of the cave lay beneath the stalagmite, and contained numerous pieces of charcoal, seems to indicate some more continuous occupancy of the cave by man than at the time when the red earth was accumulating. Then comes the stalagmite, in which but few remains, whether human or otherwise, have been found, and these for the most part may have fallen in from higher levels. It seems to indicate a vast period of time, during which the cavern was almost entirely unfrequented by man or beast, and during which the fauna of the country was undergoing those changes—by the extinction or migration of some forms of mammalian life, and the incoming of others—which are so strongly marked by the difference in the contents of the beds above and below the stalagmite. As concerns this long chapter in the history of human existence the records of the cavern are a blank.[1]

The separation of the remains of the two civilisations —Palæolithic and Neolithic—by a layer of stalagmite, the deposition of which, generally speaking, implies a long, though often vague and uncertain, period, renders it impossible to trace any evolutionary connection between the people who frequented the cave before and after the occurrence of this phenomenon. Hence, to find a satisfactory explanation of the gap in human civilisation thus disclosed is one of the most urgent problems of the day, and we shall return to it after glancing at some of the contemporary phenomena on the Continent.

Belgian Caves.

Notwithstanding Dr Schmerling's early researches, it was not till the latter part of 1863, when the din of strife and sensational discoveries in other countries echoed far and wide, that the Belgian authorities be-

[1] Ancient Stone Implements, &c., p. 465.

came alive to the importance of their caverns. Some of the leading savants, stung with reproach for having left it to foreigners to recognise the true significance of their famous countryman's early discoveries, conceived the project of exploring the caverns on the banks of the Meuse and Lesse, on a scale commensurate with the acknowledged importance of the subject. M. Vandenpeereboom, the Minister of the Interior, to whom the matter was referred by the Academy of Science, at once undertook to supply the necessary funds. On the recommendation of Professor Van Beneden, M. E. Dupont was engaged to conduct the investigations. Active operations were begun in 1864 and continued for eight years, during which upwards of sixty caverns were explored. Nearly 40,000 bones were examined anatomically, and classified under the various species of animals they represented; while not less than 80,000 worked flints were collected. Judging from the work done at Furfooz in clearing out the *Grotte des Nutons* and the *Trou du Frontal,* the only two stations I have had an opportunity of inspecting, the labour must have been very arduous.

Dr Dupont classified all the relics found in these caves into the following consecutive groups:—

1. *Âge du Mammouth.*—The relics associated with the mammoth and the quaternary fauna were found to be lowest, and coeval with the time when the swollen rivers occasionally overflowed into the caves and left stratified beds of gravel or mud over their floors.

2. *Âge du Renne.*—The period when the rivers, by excavating the valleys more deeply, ceased their fluvia-

tile deposits in the caverns, and so left them above the present highest flood-marks. The portion of their contents representing this stage was characterised by the presence of angular blocks mixed with brick-earth. Most of the extinct animals — mammoth, rhinoceros, Irish elk, hyena, cave-lion, and cave-bear — are no longer represented. Of the fauna of the previous age the reindeer alone is the most characteristic which still survives, and hence his reason for giving it the name "Reindeer period."

3. *Époque actuelle.*—The superficial blackish *débris* —the accumulated dust of modern ages—he assigned to the period now in progress, when only the fauna and relics of neolithic and modern times are to be met with, the reindeer having also vanished from the locality.

M. Dupont, in his excellent memoir, 'Les Temps Préhistoriques en Belgique,' engraves some objects made of reindeer horn, which he assigns to the Mammoth Period. These are a few arrow and spear points, a doll-like object suggesting an attempt at modelling the human trunk, a *bâton de commandement,* and some articles showing efforts at rudimentary carving. The flint relics from the Reindeer period are said to manifest greater skill in their manufacture, especially in the process of secondary chipping. Fragments of coarse pottery have also been noted; but only in one instance were the pieces sufficient to determine the contour of the vessel. But it is to neolithic man, who also haunted these retreats, that we must assign the earthenware, as well as the sepulchral remains of the extremely brachycephalic race found in the *Trou du Frontal.*

The entire collection of relics from these caverns is preserved and well exhibited in the *Salle du Mammouth* in the Royal Museum of Natural History in Brussels. Besides tickets describing the bones anatomically and zoologically, there are skeletons, plans, and geological sections of the different caverns, so that at a glance the visitor can have a fair idea of the character of the remains.

In addition to the cave relics there is in the same place another collection of roughly chipped flint instruments from Mesvin, near Mons. These were found in a gravelly stratum resting immediately over tertiary deposits, but below two distinct beds of mud (*limon*). The special interest attached to them lies in the fact that in the same stratum were found the bones of some of the extinct quaternary fauna.

The existence of palæolithic man in Belgium has thus been proved from two sources: (1) The association of his works with a fauna characteristic of the Quaternary period, whose bones bear evidence of having been transported into caves and otherwise manipulated by the Troglodyte hunters; (2) The actual discovery of his industrial remains in geological deposits incontestably belonging to the Quaternary period.

Archæological Activity in France.

It was not likely that the savants of a country, so rich in prehistoric remains as France, would remain passive while the natural evolution of Man was being openly discussed in scientific circles throughout Europe. Their first consideration was to secure a proper museum—then

a real desideratum in France—for the preservation of the relics of past humanity which were then so copiously announced from almost every department of the empire. When the great collections of the Old-World civilisations, which now adorn the halls of the Louvre, Hôtel Cluny, and the Palais des Thermes, were organised, prehistoric archæology was scarcely known, and so this department had little space assigned to it in any of these Museums. To remedy this defect the old chateau of St Germain, at St Germain-en-Laye, which was fast falling into ruins, was restored and fitted up as a special museum for the prehistoric antiquities of France. It was opened to the public in 1867, and, though the remodelling of the entire building is not yet completed, the French authorities have succeeded in bringing together a series of national antiquities, from the earliest tracings of primitive man up to the eighth century, which, for methodical arrangement and wealth of illustration, is nowhere surpassed. The portion of the building in which these relics are displayed extends over three flats, comprising twenty-two rooms, many of them being spacious halls.

No sooner was the National Museum fairly started, and its future prosperity secured under the administration of such competent men as Alexander Bertrand and Gabriel de Mortillet, than attention was directed to the best means of preserving the larger antiquities scattered throughout the country. This project was mooted for several years, but, owing to the Franco-Prussian war and other difficulties, it was not till 1879 that a practical issue was arrived at. On the 21st November of that year M. Jules Ferry, Minister of Public Instruc-

tion, appointed, as an adjunct to the Commission of Historical Monuments, the *Sous-Commission d'inventaire des monuments mégalithiques et des blocs erratiques de la France et de l'Algérie.* The first object of this Committee was to get a summary inventory of all the megalithic monuments known in the country, so as to act as a basis for future work. For this purpose France was divided into six divisions, and each division was put under the superintendence of a member of committee. Circulars explaining the object of the investigation, as well as an exhaustive list of queries regarding the different kinds of antiquities, were issued to all parties likely to give reliable information. This work was so quickly prosecuted that in the following year an inventory was published giving the number of dolmens, menhirs, allignments, cromlechs, polishers, cup-stones, rocking-stones, and any other peculiar stones, in every communal district in France. The *Sous-Commission* is now actively engaged in purchasing and restoring the most necessitous of these monuments, especially such as happen to belong to small proprietors who are not likely to take due care of them.

In Britain no special school for the study of anthropology has yet been founded, but in France there is *l'École d'Anthropologie*, with a staff of twelve professors, who apportion the subject as follows:—

Géographie médicale.	Histoire des civilisations.
Anthropologie pathologique.	Anthropologie zoologique.
Anthropogénie et embryologie.	Anthropologie physiologique.
Ethnologie.	Ethnographie comparée.
Anthropologie biologique.	Anthropologie préhistorique.
Linguistique et ethnographie.	Anthropologie géographique.

Reindeer Period in Central Europe.

The exploration of a number of caves and rock-shelters in the valley of the Vézère, in the Dordogne district, France, by Messrs Lartet and Christy, contributed materials of the highest significance both to anthropologists and archæologists. The result of their investigations was published in a large and richly illustrated quarto volume, entitled 'Reliquiæ Aquitanicæ' (1865-75), which revealed a unique phase of human

Fig. 1.—*Handle of a dagger sculptured into the form of a reindeer. Rock-shelter of Bruniquel* (⅔).

civilisation. Ignorant of agriculture and the ceramic art, and having no domestic animals, not even the dog, these Dordogne cave-men successfully hunted the reindeer, mammoth, and other wild animals, with only such weapons as they could manufacture of flint and bone. Mr T. Rupert Jones in his preface to the above-named work thus pithily describes their daily avocations:—

Their habits have been elucidated in the descriptions of their weapons and other implements adapted for shooting or darting, stabbing, clubbing, cutting, chopping, flensing, scraping, smoothing, grinding, boring, drilling, and other work, wanted either in peace or war, in hunting and fishing, in domestic operations,

and in designing the works of art which so markedly characterised this peculiar people of Western Europe. Their cooking-stones, hearths, and mortars; their bodkins and sewing-needles; their personal ornaments and amulets, perforated for stringing, their whistling instruments, and their batons, possibly distinctive of rank and dignity, have received much attention, as the memoirs and descriptions by E. Lartet in particular will show. Even their owner-marks, tally-scores, and probably gambling-tools have been recognised and described in this work.

Fig. 2.—*Mammoth sculptured in reindeer-horn. Rock-shelter of Bruniquel* (⅔).

But, what is still more remarkable, under these circumstances they developed a wonderful taste for art, and left behind them a collection of sculptures and engravings which, for spirit and artistic effect, would not disgrace our modern Landseers. By a few scratches on bone and ivory, they faithfully depicted the characteristic features of the animals, hunting scenes, and industries among which they lived. The handles of their poniards and other objects were ornamented, not only with geometrical and bizarre figures of straight, curved, and zigzag lines, but sometimes carved to represent animals (Figs. 1 and 2). In this kind of sculp-

PLATE I.

MAMMOTH ENGRAVED ON A PIECE OF IVORY, LA MADELEINE. (E. LARTET ($\frac{1}{2}$))

turing they displayed great ingenuity in adapting the material at their disposal to the production of a fantastic

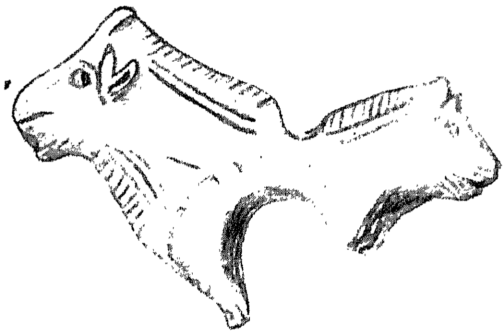


Fig. 3.—*Portion of a* bâton de commandement *of reindeer-horn. Laugerie Basse* (½).

piece of art, but which always delineated some characteristic trait of the animal represented (see Pls. I. to III. and Figs. 1 to 8). The staple food of these Troglodytes was the reindeer, and hence the time in which they lived is often known as the Reindeer period (Magdalénien).

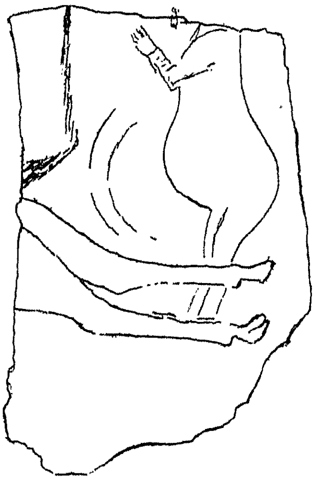


Fig. 4.—*Fragment showing outline of a woman and reindeer. Laugerie Basse* (⅔).

Characteristic remains of this civilisation have been found in numerous localities throughout Central Europe, especially the south of France. Among the more important collections illustrative of its unique art, in addition to those already mentioned, are those of *Vicomte de Lastic Saint-Jal*, from the rock-shelter of Bruniquel

(Tarn et Garonne); of *M. Elie Massénat*, from the Dordogne district; and of *M. Ed. Piette*, from the caves of

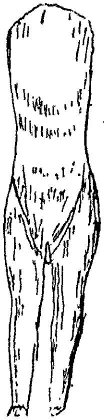


Fig. 5.—*Woman sculptured in ivory. Laugerie Basse* ($\frac{2}{3}$).

Fig. 6.—*Human head engraved on a fragment of reindeer-horn. Grotto of Rochebertier (Charente)* ($\frac{2}{3}$).

Arudy and Mas-d'Azil (Ariège),—all of which were exhibited at the Paris Exhibition of 1889. The stations

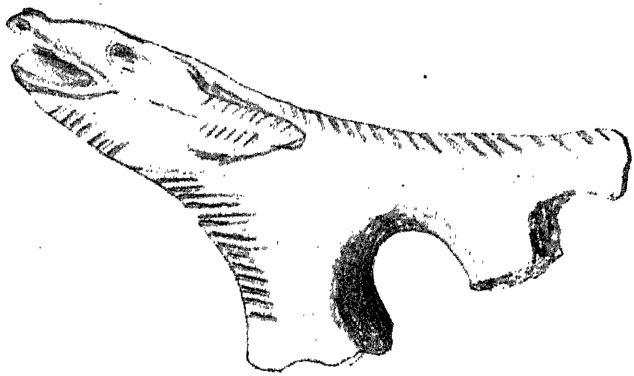
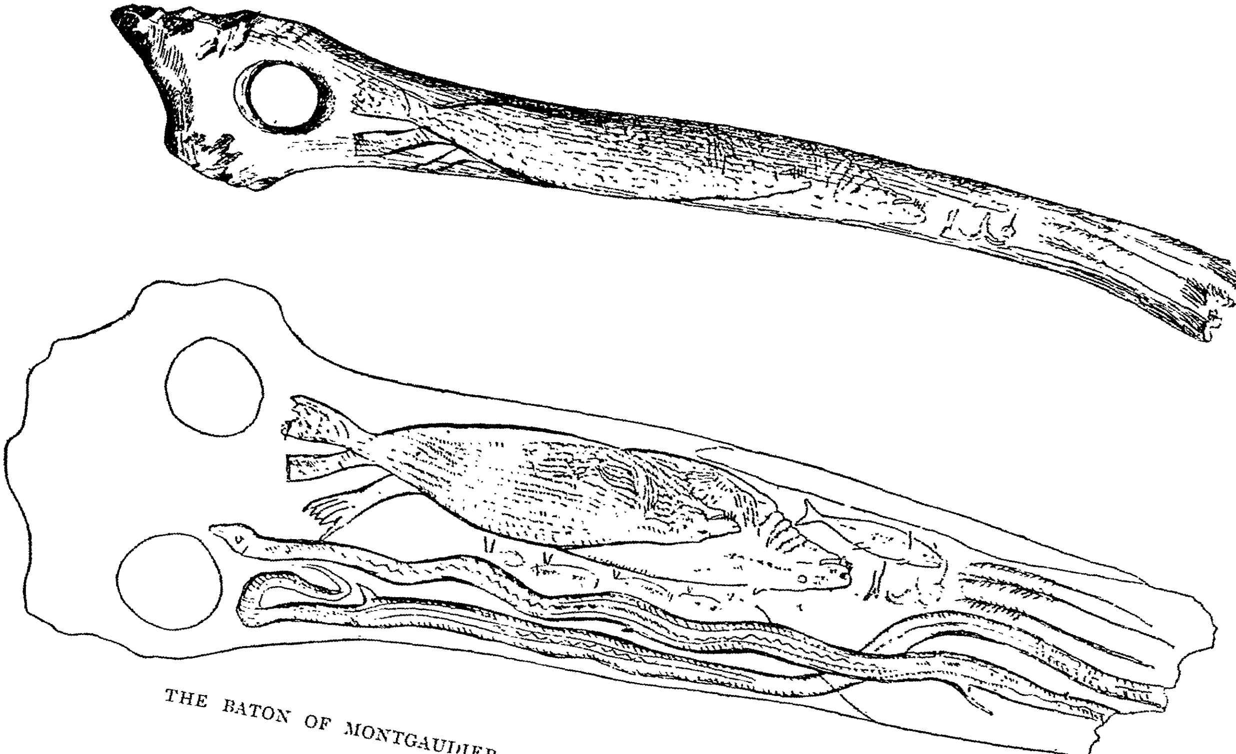


Fig. 7.—*Unknown animal sculptured in reindeer-horn. Laugerie Basse* ($\frac{1}{1}$).

at Lortet (Haute-Pyrenées), Montgaudier (Charente), Grotte de Reilhac (Causses du Lot), Thaïngen (Switzer-



THE BATON OF MONTGAUDIER. ENGRAVED WITH SALMON AND EELS. (COLL. POGNON.)

PLATE II.

land), and others, have also yielded some further specimens of the artistic taste of this period.

While the flora of their environments is scarcely represented at all by those artists of the Reindeer period, the fauna is depicted in endless variety, over 300 specimens having now been collected—representing man, mammoth (Pl. I.), reindeer (Fig. 1), auroch, horse (Pl. III. Fig. 1), bull (Fig. 3), wild-goat, saïga, bear, salmon and other kinds of fish (Pl. II.) It is also remarkable that although their geometrical figures are

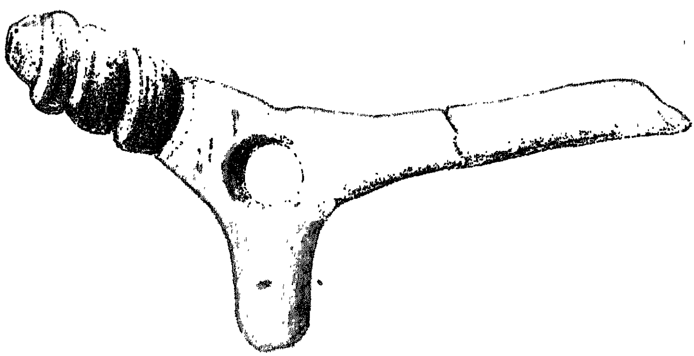


Fig. 8.—Bâton de commandement *of reindeer-horn.* *Coll. de Maret* (½).

extremely varied, not a single circle has yet been observed among them.

Of singular interest are a few representations of men and women (Figs. 4, 5, and 6), all of which are nude, although a female form seems to be adorned with bracelets and a necklace (Coll. Piette). This figure comes from Laugerie Basse, as well as another, of the same sex, sculptured in ivory (Fig. 5) (Coll. de Vibraye), and one of a man creeping on his belly, and in the act of hurling a spear at an auroch (Coll. Massénat). Another

figure, engraved on portion of a *bâton de commandement*, from La Madeleine (*Musée de St Germain*), represents a man walking, and carrying a club on his right shoulder (Pl. III.) Although the few illustrations here introduced are inadequate, both as regards variety and execution, to give a correct representation of the style of art practised by these Reindeer-hunters—some of the sketches having been too hurriedly taken to pass muster for the genuine works of the original artists—yet they help to emphasise these very remarkable art-products of early civilisation. For further information I must refer you to special works on the subject, as well as to some of the popular handbooks on archæology, such as those of Lubbock, Boyd-Dawkins, Cartailhac, De Mortillet, &c.

Sepulchral Caves.

The discovery, at various times within the last quarter of a century, of human remains in a series of caves along the sea-face of the Red Rocks, near Mentone, has given rise to an embarrassing discussion as to their age. M. Rivière, who first undertook a systematic examination of them on a scale commensurate with their importance, considered the skeletons disinterred by him to be the veritable remains of the Palæolithic people, because they were buried in deposits which admittedly belong to that period.[1] But, on the other hand, there are archæologists, including Professor Boyd-Dawkins,[2] who deny that the facts

[1] De l'antiquité de l'homme dans les Alpes Maritimes, 1887.
[2] Early Man in Britain, p. 229.

FIG. 2.—A GROUP WITH HUMAN FIGURE ($\frac{1}{1}$).

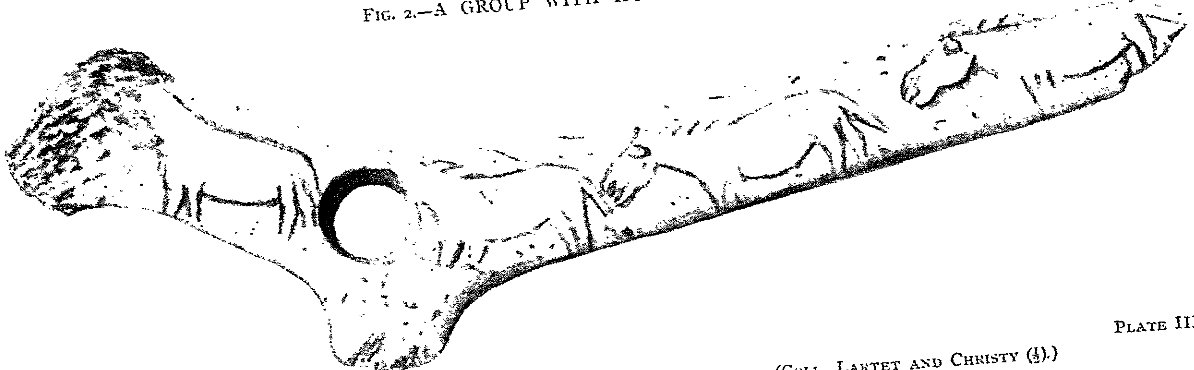


PLATE III.

FIG. 1.—BÂTON DE COMMANDEMENT, FROM LA MADELEINE. (COLL. LARTET AND CHRISTY ($\frac{1}{2}$).)

bear this inference, and who regard the bodies as interments of a much later period.

There appears to be no doubt that the lower portion of the cave-earth was of quaternary origin, as it contained remains of the cave-lion, cave-bear, hyena, mammoth, *Rhinoceros tichorinus*, *Bos primigenius*, horse, various kinds of deer, &c. It is interesting to observe that the reindeer is not included in this list—a fact which, it has been suggested, shows that during the glacial period the northern fauna had not migrated so far south. The industrial relics found scattered throughout the *débris* are not sufficiently pronounced in their *technique* to be of much chronological value. Worked implements of quartz, characterised as Moustérien,[1] were met with in the lower strata, while others of flint and of better workmanship, as well as a few primitive objects made of bone, were encountered higher up in the cave-earth. But in none of them were there worked objects at all comparable to the highly finished weapons of the Dordogne cave-men. In one or two instances objects of neolithic type, such as a broken polished stone celt, and some pieces of jade, were discovered in the black earth on the surface.

It was in *débris* of this kind that the skeleton known as the "fossil Man of Mentone" was discovered by M. Rivière in 1872. It lay on the left side in the attitude of sleep, the head resting on a stone, and the knees slightly drawn up. Its position was near some large stones at the right lateral wall, about 7$^{m.}$ from the entrance and 6·55$^{m.}$ below the surface of the cave-

[1] L'Homme, 1887, p. 344.

earth. Over the head, and partially adhering to the bones, were some 200 shells (*Nassa neritea*) and 22 canine teeth of deer—all perforated by the hand of man—evidently forming the remains of a head-dress. Another group of 41 similar shells was observed below the left knee. Further, in the vicinity of the head were two worked flint-flakes (broken), a deer-bone artificially pointed, and a quantity of ferruginous powder, which tinged everything around it—bones and shells—with a ruddy colour. The soil, both above and below the skeleton, contained bones of some of the extinct quaternary fauna; and scattered through it were a few shells of non-Mediterranean species (*Purpura lapillus* and *Littorina littorea*). The skeleton was that of a tall man, some 6 feet in length, with a dolichocephalic skull, and many of the other characteristics of the Cromagnon race.

According to Mr Moggridge,[1] "there were five floors formed in the earth by long-continued trampling; on each, and near the centre, were marks of fire, around which broken bones and flints were abundant, except upon the lowest, where but few bones occurred, and no flints."

M. Rivière's excavations extended over a period of six years (1870-75), during which he carefully explored seven caverns. Of these, six contained evidence of having been inhabited by man, and four were used as his sepulchres—viz., 1st, 4th, 5th, and 6th. Six skeletons were disinterred, all of which gave more or less indications of having been accompanied by burial deposits similar to those above described. The fauna

[1] British Association Report, 1871.

numbered no less than 282 species, of which 111 were vertebrates (60 mammals, 42 birds, 2 reptiles, and 7 fishes) and 171 invertebrates.

In 1884 a human skeleton was found in the Barma Grande cave, at a depth of $8{\cdot}50^{m.}$, and along with it three flint knives placed near the head. It lay under a bed of ashes containing the teeth of ruminants. The skull was broken into a number of pieces which, on being put together, disclosed the characteristics of the Cromagnon type—viz., a dolichocephalic head and a lofty forehead over somewhat prominent superciliary ridges.

On the 7th February 1892 three other skeletons were discovered in the same cave, close to where the former had lain, and associated with them were the following objects: three flint knives, a number of pierced shells, fish vertebræ, the perforated teeth of deer, some of which were adorned with incised lines, pieces of worked bone with egg-shaped ends, also adorned with a variety of patterns in incised lines, &c. One rather remarkable fact is that no pottery was found along with any of the skeletons. Whether these human remains were contemporary with the natural deposition of the matrix in which they lay, or subsequent interments, is still keenly debated. On this problem a few remarks will be made in a subsequent section of this chapter.

Further details of these later discoveries are lucidly set forth in an article by Mr Arthur J. Evans "On the prehistoric interments of the Balzi Rossi caves, near Mentone, and their relation to the Neolithic Cave-Burials of the Finalese."[1] The literature on these

[1] Journ. of the Anth. Inst., 1893, vol. xxii. p. 287.

Mentone discoveries is, however, too voluminous to be condensed here; but I may mention that readers who are specially interested in the subject will find ample references in a recent article, reviewing the whole series of these cave explorations, by Dr Colini of Rome.[1]

Another discovery which Sir Charles Lyell unhesitatingly accepted as a sepulchral vault of the Post-pliocene period, although it is now generally admitted that the interpretation put upon the phenomena was not justified by the facts, may be here shortly described by way of illustrating the extreme caution requisite, even by the most competent authorities, before promulgating startling conclusions. This was the grotto of Aurignac (Haute-Garonne), near the Pyrenees, which, prior to 1852, was concealed by a talus, and only then accidentally discovered by a workman in pursuit of a rabbit. The entrance to the grotto was closed by a stone slab, and inside were the remains of seventeen human skeletons, which, on the discovery becoming known, were, by orders of the mayor of the town, removed and re-interred in the parish cemetery. In the trench made through the talus, as well as inside the cavern, were found the bones of animals and works of art which, on being subsequently shown to M. Lartet, induced that eminent palæontologist to reinvestigate the whole matter. The result was published in 1861,[2] under the title "Nouvelles Recherches sur la coexistence de l'homme et des grands mammiféres fossiles reputés caractéristiques de la dernière période géologique." On exam-

[1] Bull. di Palet. Ital., 1893, pp. 117 and 233.
[2] Annales des Sciences Nat., 4th series, vol. xv. p. 177.

ination of the grotto M. Lartet found, outside the flagstone which closed the entrance, along with ashes, pottery, bone and flint implements, the broken bones of numerous extinct animals, among which the following were identified—viz., hyena, cave-bear, cave-lion, rhinoceros, reindeer, Irish elk, and mammoth. All these were supposed to be contemporary with the sepulchral remains; but the latter are now regarded as neolithic, and of course long subsequent to the time when the cave was a place of resort to the palæolithic hunters.

Distribution of Palæolithic Man.

We have now seen that the evidence on which the antiquity of Man has been pushed back into the domain of geology is derived mainly from the contents of caves and aqueous deposits of quarternary times.[1] In their periodical wanderings in quest of sustenance the Palæolithic people frequented such natural shelters as were most convenient in the vicinity of the hunting-fields. Caves were evidently favourite places of resort, for in many of them traces of human occupancy are discernible, even to this day, in food-refuse, stray weapons and tools, and sometimes the bones of individuals who there found a final resting-place. Outside these haunts similar objects are also occasionally met with; but the area to be searched being so wide, and there being few external indications to guide one,

[1] See Professor Prestwich, 'Nineteenth Century,' April 1895; and Report "On Relation of Palæolithic Man to Glacial Period," in 'British Association Report for 1896, p. 400.

the discovery of these long-concealed remains is a slow process. Hitherto the most abundant objects are those strange-looking implements or weapons of flint which have been so largely disinterred from the ancient river-gravels of England and France.[1] We have already descanted on the difficulties and controversial struggles which their earlier discoverers had to surmount before they converted an incredulous world to the belief that they were of human workmanship at all. Once, however, the fact was established beyond all controversy, similar discoveries advanced by leaps and bounds. To enumerate the localities and particulars of all the recorded "finds" up to date would be a work of considerable labour, much more so if accompanied by an attempt to decide their claim to be genuine palæoliths. It must therefore suffice here to say that the existence of Palæolithic man has been satisfactorily proved in South Britain, Belgium, France, the Spanish Peninsula, Italy,[2] Austria,[3] Central Russia,[4] Syria and Palestine,[5] Eastern India,[6] Somaliland,[7] Egypt.[8]

This is but a meagre outline of the evidence of the distribution of Palæolithic Man in the Old World, but it is sufficient to show that when we first come in contact with his remains in Europe he had already

[1] See 'Ancient Stone Implements'; and 'Musée Préhistorique.'

[2] An excellent account of the more recent discoveries of the remains of human industries in Quarternary times in Italy is given in 'Revue Mensuelle,' 1891, by A. de Mortillet.

[3] Cong. International d'Anth. et d'Arch., 1874 and 1876.

[4] Ibid., 1893. [5] Ibid., 1876. [6] Ibid., 1868.

[7] Journ. Anth. Inst., vol. xxvi.; Brit. Association Report, 1896.

[8] Flinders Petrie, 'Naqada and Ballas,' 'Illahun,' 'Tell-el-Amarna,' &c.

spread over and dominated the larger portion of the habitable globe. Having no opportunity of forming an independent opinion of the often-reported discoveries of the remains of Palæolithic man in the New World, I have said nothing on the subject. I appeal, in justification of this attitude, to the scepticism with which the subject is still regarded in many quarters. Notwithstanding the most precise and circumstantial details of the finding of numerous skulls and industrial implements of quaternary, and even of tertiary, man in North America, this is how Dr Brinton concludes a recent article on the oldest stone implements in the Eastern United States:—

"I conclude, therefore, by the statement that in the Eastern United States, a region in which I have visited most of the important stations and seen most of the typical collections, the oldest stone implements present nothing in form or appearance, and have not in the history of their discovery any sure connections, which would convey them in time or in art development to an earlier people or culture than that of the American Indian, as he was found by the earliest European voyagers.[1]

The Marquis de Nadaillac, a most competent authority on American archæology, thus writes in the 'Revue des questions scientifiques' for August 1893:—

Il n'est plus douteux que de nombreuses découvertes faites sur le grand continent qui s'étend de l'Atlantique au Pacifique, sont absolument fausses, du moins quant à l'ancienneté que l'on prétend leur attribuer. Pour d'autres, après les travaux

[1] Journ. of the Anth. Inst., August 1896.

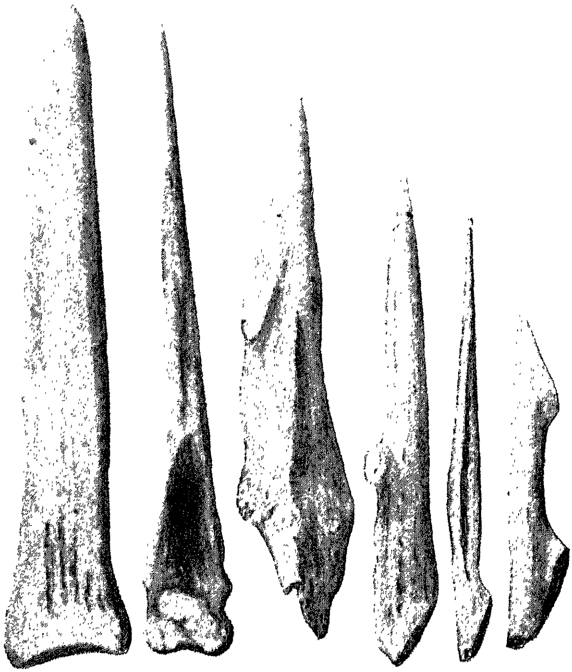
récents que je viens de résumer, de graves doutes sont permis. Il en reste cependant dont l'authenticité ne peut être sérieusement questionnée. Je citerai en première ligne les argillites de Trenton; après l'examen qui a été fait par un des maîtres de la science contemporaine, M. A. Gaudry, après l'exposé si clair de M. Boule, toute hesitation doit cesser; et ce seul fait, si même il n'était corroboré par aucun autre suffirait à établir l'existence d'un homme semblable à nous sur les rives du Delaware durant les temps paléolithiques, et à rendre cette existence probable sur d'autres points où la nature était aussi riche et la vie aussi facile.

The "Hiatus" between the Palæolithic and Neolithic Civilisations in Europe.

With regard to the so-called *hiatus* which some archæologists are in the habit of describing as having intervened between the palæolithic and neolithic civilisations in Europe, I may state that I have elsewhere[1] discussed the question in its general aspects. I then pointed out that in many of the caves and rock-shelters of the Reindeer period in France the relic-bearing *débris* of the successive civilisations followed each other without any apparent discontinuity of occupancy. Among the facts advanced in support of this contention were the investigations of M. Ed. Piette in the cave of Mas-d'Azil, on the left bank of the Arise (Ariège), and of MM. Cartailhac and Boule in the cave of Reilhac (Causses du Lot). Some of the more remarkable relics collected in the former locality I had an opportunity of studying at the Paris Exhibition of 1889, as member of the International

[1] Rambles and Studies in Bosnia-Herzegovina and Dalmatia.

Congress of Anthropologists and Archæologists. Since then M. Piette has written a more detailed account of the structure and contents of the deposits, which, according to him, correspond with the period of transition between these two civilisations.[1] Above a

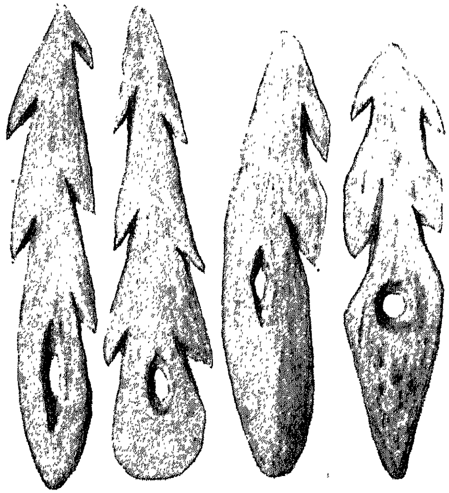


Figs. 9 to 14.—*Bone implements from the cave of Mas-d'Azil, France.* (*Coll. Piette*) ($\frac{2}{3}$).

stratum containing relics characteristic of the Reindeer age, but beneath deposits with relics equally characteristic of the Neolithic period, he describes two beds, the combined depth of which amounted to about 4 feet, which yielded the relics I am now about to refer to.

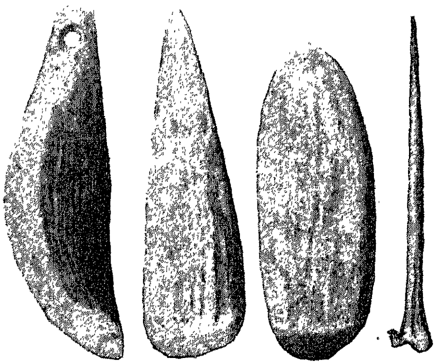
[1] L'Anthropologie, vol. vi. p. 276; and vol. vii. p. 1 and p. 385.

The lower of these two beds was composed chiefly of ashes and wood-charcoal, intermingled with some



Figs. 15 to 18.—*Harpoons made of stag-horn from the cave of Mas-d'Azil.* (*Coll. Piette*) ($\frac{2}{3}$).

fallen rocks. The thickness of this bed was 0·65$^{m.}$, and among its contents the following relics were found: Flint knives and scrapers; a number of perforated deer-teeth, arranged as if they had formed a necklet, also other perforated teeth (Fig. 19); pins, polished pointers, and spatulæ of bone (Figs. 9 to 14, 20 and 22); barbed harpoons made of stag-horn, some being



Figs. 19 to 22.—*A bear's tooth, a horn chisel, a stone implement, and a bone pin from the cave of Mas-d'Azil.* (*Coll. Piette*) ($\frac{2}{3}$).

perforated at the butt-end with an oval hole, and others having the barbs only on one side (Figs. 15 to 18); also a large number of pebbles of quartz or schist—such as could be picked up from the bed of the river—some round and pestle-shaped, showing usage markings at one end (Fig. 21), and others flat or oblong, having various devices painted on them with peroxide of iron (Fig. 23). The fauna was represented by bones of the stag, *Cervus canadensis*, roebuck, chamois, ox, horse, common bear, wild-boar, badger, wolf, beaver, rat, and of some birds and fishes. Grains of wheat and a variety of fruit stones and seeds were also identified. The larger bones of two human skeletons, which appeared to have been buried after the flesh had been removed, had also been marked with red patches of the peroxide of iron.

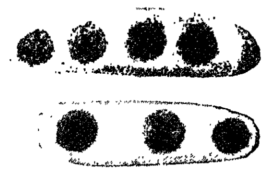


Fig. 23.—*Pebbles painted with red spots from the cave of Mas-d'Azil.* (*Coll. Piette*) ($\frac{2}{3}$).

Superimposed on this bed, but passing from it almost insensibly, were deposits of wood-ashes (0·60$^{m.}$ in thickness) streaked with bands of grey, white, and red, in which were embedded quantities of land-shells (*Helix nemoralis*), evidently the remains of repasts. These shell-heaps were intercalated between the layers of ashes, and extended over several yards, with a maximum depth of about one foot. In this bed (*Assise à escargots*) were also found harpoons and

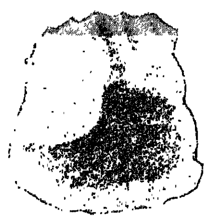


Fig. 24.—*Flint implement with a polished cutting edge from the cave of Mas-d'Azil.* (*Coll. Piette*) ($\frac{2}{3}$).

other relics similar to those in the bed of coloured pebbles; and in addition to these there were portions of small chisel-like implements of stone with polished cutting edges (Fig. 24), but no regular stone axes—only in the superincumbent layers were the latter found—and above all came objects of bronze and iron. It was also remarked that the snail-shells had become altered to the variety known as *Helix hortensis*, which, it is said, indicated a drier climate.

According to M. Piette, there were changes in the external environments which could be correlated with these successive deposits. As the Reindeer period passed away, the climate became ameliorated but humid, as inferred from the presence of fruit-trees and the cultivation of grain. The people appeared to have lost their artistic taste for carving on bones, and, instead of it, they manufactured harpoons of red-deer horn without a trace of ornament, painted selected pebbles with quaint devices—often mere strokes or dots—as in Fig. 23, and practised some obscure sepulchral rites in which the red paint on the desiccated bones seemed to play a part. M. Piette classifies these painted stones into numerals, symbols, pictographs, and alphabetical characters; and to illustrate his views he has issued a series of coloured plates showing the designs on some hundreds of these pebbles. Into the elaborate theories and discussions raised on these points I will not now follow the author, as I have a more special object in view—viz., to point out the remarkable similarity of the harpoons and some of the industrial objects from Mas-d'Azil to a series

of analogous relics recently found in a cave at Oban, in Scotland, and described by Dr Joseph Anderson.[1] The bone and horn implements from this locality consist of three pins (Fig. 25); three borers (Fig. 26),

Fig. 25.—*Pin.* (Actual size.)

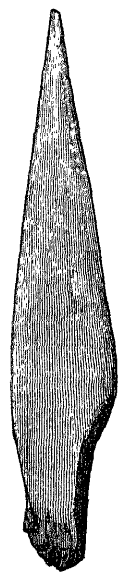


Fig. 26.—*Borer.* (Actual size.)

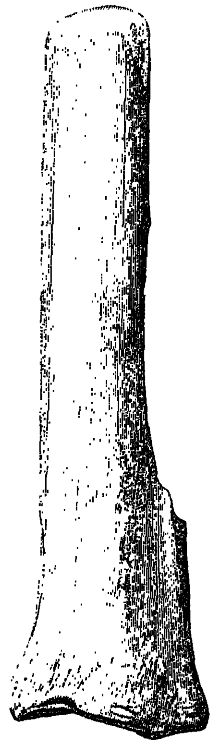


Fig. 27.—*Implement made of the leg-bone of a deer* ($\frac{3}{4}$).

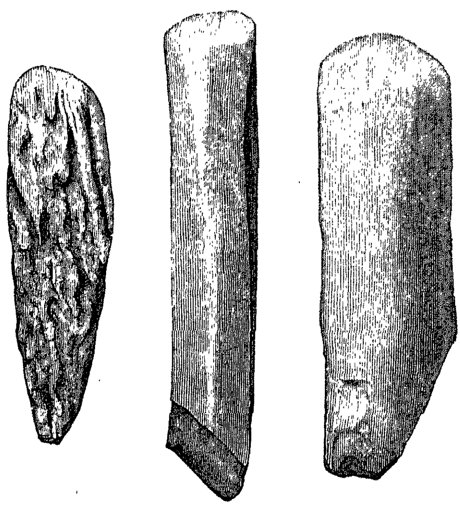
VARIOUS BONE IMPLEMENTS FROM A CAVE AT OBAN.

together with a few bones merely pointed or flattened at the end; 140 chisel-like implements (Figs. 28, 29, and 30); and seven harpoons (two only being entire) made of stag-horn (Figs. 31 and 32).

[1] Proc. Soc. Antiquaries of Scotland, vol. xxix. p. 211.

E

'Now, it will be observed that not only do the harpoons from these two widely-separated localities agree in the material of which they are made—viz., deer-horn—but also in the shape of the stem, the method of cutting the barbs, and the frequent presence of a hole in the butt-end. And this is all the more remarkable because the contrast between them and the harpoons so frequently found in palæolithic times in France,

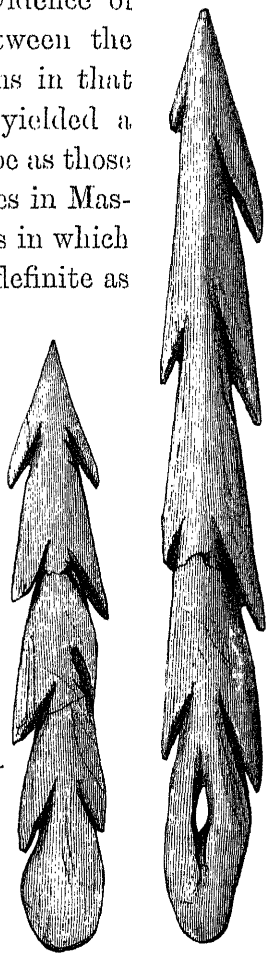


Figs. 28, 29, 30.—*Implements of bone and deer-horn from a cave at Oban.* (Actual size.)

Belgium, Switzerland, and England—among which there is also a strong family likeness—is very pronounced. The former are characterised as having a flat stem with bilateral or unilateral barbs formed by mere notches, but without ornamentation, and as being generally made of stag-horn. On the other hand, the latter are frequently real works of art. The stem is round and polished, the barbs stand freely out from the stem,

and are often ornamented with two or more parallel grooves, and the material is always reindeer-horn.

The other cave, Grotte de Reilhac—instanced in my Bosnian sketches as supplying evidence of the shortness of the interval between the palæolithic and neolithic civilisations in that part of France—has also, I find, yielded a number of harpoons of the same type as those from the bed with coloured pebbles in Mas-d'Azil. Although the circumstances in which they have been found are not so definite as to give them much argumentative value in chronological questions, yet the facts are by no means inconsistent with the opinion that they belonged to the same age as those from Mas-d'Azil. The contents of the cave having been largely removed by the proprietor before the matter came under the notice of MM. Cartailhac and Boule, there remained only a small portion of undisturbed material from which the relative sequence of the deposits could be ascertained. So far, under these conditions, as the investigators determined the nature of the deposits, they were as follows, from above downwards :—



Figs. 31, 32.—*Harpoons made of deer-horn from a cave at Oban* ($\frac{3}{4}$).

(*a*) A bed of blackish earth containing clay, charcoal,

angular pieces of the limestone rock, and shells (*Helix nemoralis*), mostly very much broken. The soil, generally loose, was here and there cemented by stalagmitic deposits. Bones of the deer, ox, and horse, together with small worked flints and minute fragments of pottery, were also collected in it.

(*b*) Then came a veritable *breccia* of rabbit-bones mixed with charcoal, ashes, and angular pieces of rock —the whole cemented by a stalagmitic matrix. It also contained, especially in its lower portion, the bones of larger animals; and one of the investigators found in it a portion of a slender bone ornamented by cut notches like a "tally"-stick.

(*c*) The next stratum was of great thickness (over 6 feet), and presented a reddish colour, which it had gradually assumed. Its substance was a homogeneous clayey earth, mixed with the usual angular fragments from the walls of the cave, in which were found many flint implements and worked bones—some of the latter being characteristic of the Reindeer period.

In classifying these three deposits, according to the remains of the fauna collected in them, the authors state that the superficial layer *a* represented the Neolithic period, and that both *b* and *c* corresponded with the Reindeer age. After contrasting the scarcity of the remains of the reindeer with the abundance of those of the red-deer, and commenting on the almost entire absence of the extinct and emigrated animals, they make the following remarks pertinent to the problem now at issue :—

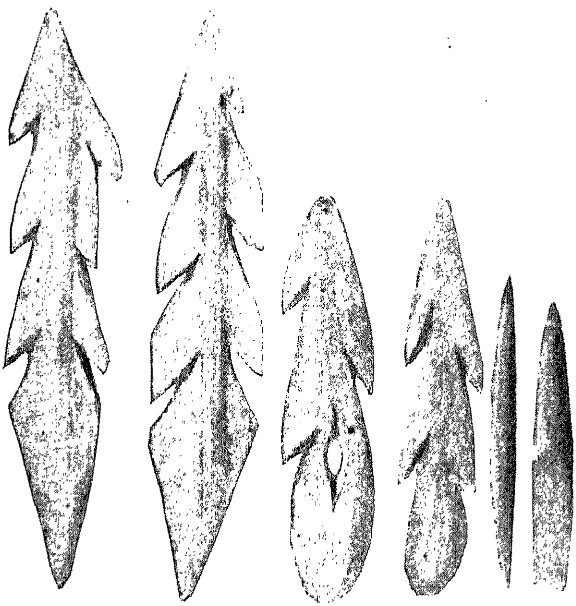
Cette absence totale d'animaux éteints et d'animaux localisés

aujourd'hui dans les régions septentrionales, jointe à la rareté relative des ossements de Rennes, nous porte à penser que les dépôts à ossements de la grotte de Reilhac correspondent à la fin du Quaternaire supérieur, et peuvent être regardés comme se rattachant de très près à l'époque actuelle. La stratigraphie nous montre un passage insensible des couches inférieures aux couches supérieures. Même les dépôts noirâtres de la superficie n'offrent pas de ligne de séparation bien nette avec les dépôts à ossements de Rongeurs. L'ensemble des deux couches est stalagmitisé de la même manière. Si leur formation n'a pas été interrompue, il ne s'est certainement pas écoulé un grand intervalle de temps entre le dépôt de ces deux niveaux.[1]

Considering the comparative lateness of the archæological horizon, here indicated on general grounds, and the impossibility of assigning the worked bone and horn objects to their precise positions in these deposits —most of them having been discovered and dispersed among collectors before the authors came on the scene— it is peculiarly significant to find in such circumstances harpoons (Figs. 33 to 36) so precisely similar to those from Mas-d'Azil and Oban. Their association with others characteristic of the Reindeer period is not, therefore, absolutely fatal to the theory that the former are exclusively products of early neolithic civilisation. Indeed a similar uncertainty hangs over almost every instance which I have seen recorded of a harpoon, of the Oban type, having been found in a reindeer cave. We have for example one with five barbs (bilateral) from Laugerie Basse figured in the 'Matériaux' (vol. v. pl. 20, fig. 6). But the circumstances do not prove it to be an exception to the above theory. Five hearths, with corresponding culture deposits, were superim-

[1] La Grotte de Reilhac, Lyon, 1889, p. 27.

posed one above the other, the highest being close upon the surface; but it was from the 3d and 4th that M. Massénat obtained the sculptured objects described in the 'Matériaux.' In which of the beds this rare har-



Figs. 33 to 38.—*Four harpoons and two small implements made of the horns of Cervidæ from the Grotte de Reilhac* (⅔).

poon was lying is not stated, but I may mention that in this same station one of the so-called whistles (Fig. 39), made of the phalangeal bone of the foot of a deer, was found. Now similar whistles have been found on some of the earlier neolithic stations, one of which I have figured along with a large harpoon from a lake-dwelling in the Untersee in my work on these habitations.[1] Another harpoon (with four barbs), perforated

[1] Lake-Dwellings of Europe, p. 131, Nos. 18 and 19.

at the butt-end, and said to be made of reindeer-horn, is recorded from the Grotte de Vache, near Tarascon (Ariège);[1] and portion of another is figured as coming from La Madeleine.[2] M. Gabriel de Mortillet[3] mentions that other specimens have been found at Gourdan (Haute Garonne) and at Lorthet (Hautes Pyrénées), but, unfortunately for my contention in the former locality, the order of their position, relative to the harpoons with round stems, is reversed. But, before accepting this statement as an unquestionable fact, I should like to have some further information on the point, more especially when I find M. Ad. de Mortillet, writing in November 1896, giving expression to the following opinion:—

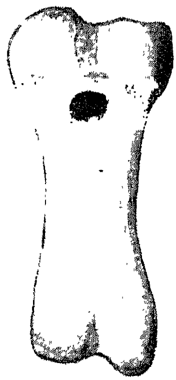


Fig. 39.—*Bone whistle made of the phalangeal bone of a reindeer's foot from Laugerie Basse.* (Actual size.)

Quant à l'assise inférieure [the bed with the painted pebbles in Mas-d'Azil], dont les pièces plus caractéristiques sont des harpons plats en corne de cerf généralement perforés, elle est contemporaine du gisement de la Tourasse, grotte située sur la commune de Saint-Martory (Haute-Garonne), qui a permis à G. de Mortillet d'établir entre le paléolithique et le néolithique une nouvelle division—l'époque tourassienne.[4]

Let us therefore inquire more particularly into the geographical and chronological range of these harpoons. As we have just seen, M. Piette assigns those from the *Assise à galets coloriés* in Mas-d'Azil to a period of

[1] Musée Préhistorique, No. 187.
[2] Reliquiæ Aquitanicæ, p. 160.
[3] Le Préhistorique, p. 405.
[4] Revue Mensuelle, 1896, p. 378.

transition between what is usually called the latest Palæolithic and the earliest Neolithic periods. MM. Cartailhac and Boule have expressed an opinion in regard to the analogous objects from the Grotte de Reilhac, which, when tested and limited by the collateral conditions, leaves scarcely any other alternative but to assign them to the same intermediate period. Although Dr Anderson is not so explicit about the age of the Oban troglodytes, yet, by expressly limiting it to the "neolithic at the earliest," he lets it be understood that the remains may be very ancient. The conclusion to which I came, when subsequently discussing the archæological phenomena of this cave, was that it was inhabited by man at a time when the mean level of the sea relative to the land stood some 30 feet higher than at present[1]—a geographical feature which must have obtained at the very dawn of the neolithic civilisation in Scotland.

Thus the conditions and collateral circumstances in which all the three groups of objects were discovered point to the view that they are the products of the earliest neolithic people who frequented western Europe. And this opinion is greatly strengthened by the fact that while these harpoons have little in common with those of palæolithic times, such as have been so abundantly collected in the Dordogne and other reindeer caves in France, they have a strong family resemblance to a large number of analogous objects found in association with remains of undoubted neolithic origin. Whatever may be the true source of their primary develop-

[1] Proc. Soc. Antiq. of London, 2d Series, vol. xvi. p. 191.

ment, they appear on the archæological horizon just on the fringe of a class of weapons which were afterwards largely used throughout Europe in pre-metallic ages. Dr Anderson states that eleven similar harpoons have been found among the contents of a refuse-heap of shells and bones within a large mound known as *Caisteal nan Gillean*, in the island of Oronsay. The other implements and weapons, with which the harpoons were here associated, appear to be of the same character as those at Oban.[1]

A harpoon of the same type (Fig. 40) was found in the Victoria Cave at Settle, in Yorkshire, in regard to which Professor Boyd-Dawkins thus writes :—

Fig. 40.—*Bone harpoon from Victoria Cave* (⅔).

At the entrance the dark Romano-Celtic or Brit-Welsh stratum lay buried, as we have seen, under an accumulation of angular fragments of stone which had fallen from the cliff. It rested on a similar accumulation which was no less than 6 feet thick, and at the bottom of this, at the point where it was based on a stiff grey clay, a bone harpoon (Fig. 40) was discovered as well as charcoal; a bone bead, three rude flint flakes, and the broken bones of the brown bear, stag, horse, and Celtic shorthorn (*Bos longifrons*). The harpoon is a little more than 3 inches long, with the head armed with two barbs on each side, and the base presenting a mode of securing attachment to the handle which has not before been discovered in Britain. Instead of a mere projection to catch the ligatures by which it was bound to the shaft, there is a well-cut barb on either side,

[1] See 'Great Auk or Garefowl,' by Mr Symington Grieve.

pointing in a contrary direction to those which form the head.[1]

Harpoons made of stag-horn have been found in many of the lake-dwellings of Switzerland, especially those of the Stone age, a few of which are figured in the various works on lacustrine archæology. Dr Keller gives specimens from Moosseedorf,[2] Wauwyl,[3] Lattringen,[4] and Concise.[5] I have also figured several specimens; one (out of about twenty) found at Cortaillod,[6] another from Baldeggersee (being one of four in a small museum at Lucerne[7]), a third from the Untersee,[8] and a fourth from Maestricht.[9] The latter, a fine specimen with twelve barbs, was found on an artificial island constructed of timbers in the valley of the Meuse; and associated with it were a number of other weapons of bone and horn, all of early neolithic types.

In these illustrations from the Swiss Pfahlbauten, one of which (Fig. 41) is here reproduced, the barbs are bilateral, and vary in number from two to twelve. Two fish-spears of a very remarkable character were found on the station of Bodmann,[10] one with four prongs and the other with two. Both were formed by cutting away

[1] Cave-Hunting, p. 111. A harpoon, with unilateral barbs only, having the last barb turned the opposite way, is figured by Montelius in his 'Antiquités Suedoises,' fig. 53.

[2] Lake-Dwellings of Switzerland, English 2d ed., Pl. V., fig. 3.

[3] Ibid., Pl. XX., fig. 26.

[4] Ibid., Pl. XLII., fig. 1; also Matériaux, vol. xv., Pl. II.

[5] Ibid., Pl. CIII., figs. 26 and 27.

[6] Lake-Dwellings of Europe, fig. 10, No. 8.

[7] Ibid., fig. 16, No. 7.

[8] Ibid., fig. 28, No. 19.

[9] Ibid., fig. 94, No. 3.

[10] Ibid., fig. 30, Nos. 3 and 5.

the interior of a thick portion of a stag-horn, as well as portions of the circumference, so as to leave the prongs in the solid. Each prong has only one barb. Single harpoons with one barb have also been noted, but they are not common, although during the Bronze and early Iron ages they appear to have been abundant. Examples made of bronze of this description were among the relics fished up from the station at Peschiera in Lake Garda.[1] In the early Iron age fish-spears have only one barb, but often several prongs (Pl. VIII., No. 14).

Fig. 41.—*Harpoon of deer-horn from Lattringen* (⅓).

Finally, harpoons similar to those from the Oban cave were common along with other varieties among the early peoples inhabiting the northern parts of Europe and America, as may be seen in many illustrated works on Scandinavian archæology; the Catalogue of the Tenth Arch. Congress at Riga in 1896, Pl. I.; and "Prehistoric Fishing," by Charles Rau.[2]

In Egypt barbed harpoons, similar to early neolithic specimens made of bone, horn, or copper, are occasionally found among ancient remains, as at Naqada and Ballas, recently excavated and described by Dr Flinders Petrie. When the implement has more than one barb, the barbs may be unilateral or bilateral. According to Dr Petrie, harpoons made of copper are imitations of those

[1] Lake-Dwellings of Europe, Fig. 64, Nos. 20, 21, and 30.
[2] Smithsonian Contributions to Knowledge, vol. xxv.

used in pre-metallic times, and have generally only one barb.[1]

But harpoons are not the only objects found among the more recent investigations in the caves of France and Italy which suggest that, between the palæolithic and neolithic peoples of Europe, there was a period of transition during which the inhabitants cannot, on archæological grounds, be regarded as the direct offspring of the former, nor yet the forefathers of the latter. The large number of perforated deer-teeth described and figured by M. Piette in his recent Album,[2] and the ferruginous red paint, so prevalent in the bed with coloured pebbles at Mas-d'Azil, have their parallels in the Balzi Rossi caves of Mentone already described. One peculiarity of the deer-teeth, in the latter, is that they are occasionally ornamented with patterns of incised lines—a feature which is also common to some bone ornaments shaped like dumb-bells. But this feature seems to me of no great importance when we bear in mind that the relics from Mas-d'Azil were found among the *débris* of a place of habitation, whereas those from Mentone had all a sepulchral origin. The incised ornamentation might, therefore, have been exceptional, and reserved for persons of distinction. Mr Arthur J. Evans has discussed at considerable length this and other points of resemblance between them and the neolithic remains in neighbouring caves on the Ligurian coast. He has also traced an analogy between the system of geometrical ornamentation on the egg-

[1] Naqada and Ballas, 1896, pp. 23 and 48.
[2] Issued with L'Anthropologie, vol. vii., 1896.

shaped bones and a style of decoration characteristic of the Stone age of Northern Europe.

"The conclusion, then, to which we are led," writes Mr Evans, "by these converging lines of evidence, is that the interments of the Barma Grande and other caves of the Balzi Rossi cliffs, though embedded in a Palæolithic stratum, are themselves of Neolithic date. On the other hand, however, the entire absence of pottery, of polished implements, of remains of domestic animals, as compared with the Neolithic interments of the Finale Caves further up the same Ligurian coast, is on any showing a most remarkable phenomenon. A greater degree of petrifaction is also observable in the bone and other objects discovered. *In all probability we have here to deal with an earlier Neolithic stratum than any of which we have hitherto possessed authentic records.*"[1]

The most serious difficulty we have to contend with in these cave explorations lies in the fact that we cannot always be certain of the stratigraphical position of the objects we are dealing with. As the records at present stand, it might be argued that such forms of ornamentation can be traced to the people of the Reindeer period, in France, because perforated teeth of different animals, including those of the red-deer, various shells from distant seas, and other ornaments, are among the relics from La Madeleine, Laugerie Basse, &c.[2] I fancy, however, there may have been some intermingling of the products of different civilisations in many of these caves. For reliable information we must therefore look to those stations where human occupancy terminated prior to the advent of the neolithic people. Such a locality we have in the Kesserloch Cave near Schaffhausen.

[1] Journal of Anth. Inst., vol. xxii. p. 301.
[2] Reliq. Aquitanicæ, B. Pl. V.

The phenomena disclosed by this cave, so far as the account of its excavation enables one to judge,[1] are somewhat analogous to those of Kent's Cavern. The superficial deposits consisted of angular rocks and *débris*, varying in thickness from about 4 feet at the entrance to 3½ inches at the inner end. Below this was a black bed called the relic-bed, having a depth of 15 inches at the outer side, but thinning out to 4 inches towards the back. Underneath this was another relic-bed 14½ to 2½ inches thick, distinguishable from the former by its reddish colour. Then, finally, came a deposit of loam, occupying the lower portions of the original rocky floor of the cave, which was entirely devoid of all animal remains. Intercalated between the superficial rubbish and the highest relic-bed were some large patches of stalagmite, 12 to 18 inches thick, which projected from the north and south walls of the cave. "The stalagmite was so hard," says Mr Merk, "that it had to be blasted with gunpowder in order to separate it from the underlying relic-bed. Both these beds of stalagmite contained on the underside a great number of bones and a few flints, evidently showing that the stalagmite had begun to form when the cave was inhabited." All the superficial stuff was removed before the relic-bed was examined, but no relics are recorded from it except a piece of black pottery, ornamented with eight cup-shaped cavities, which Mr Merk accepts as "irrefragable proof that the cave was known, but not inhabited, in the time of the Lake-dwellings." The

[1] Excavations at the Kesserloch by Konrad Merk. Translated by J. E. Lee : 1876.

relic-bed was thus clearly defined and its contents kept separate; and indeed Mr Merk expressly mentions the position of the more important relics within it. "We have," says he, "decided proofs that our Troglodytes

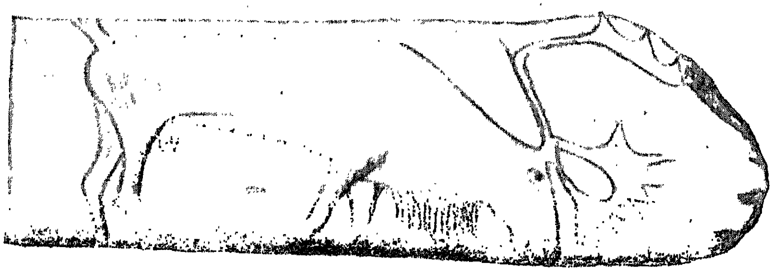


Fig. 42.—*Reindeer on a portion of reindeer-horn from Kesserloch* ($\frac{1}{1}$).

did not always remain at the same grade of civilisation during their residence at the Kesserloch; for if we investigate the position where the different implements were found, it is very striking that the ornaments,

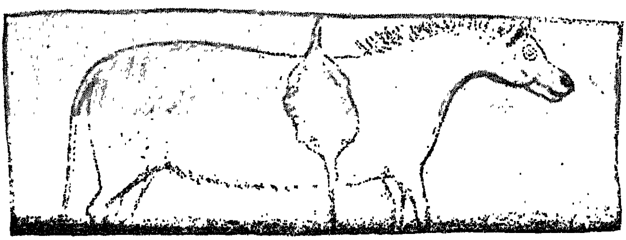
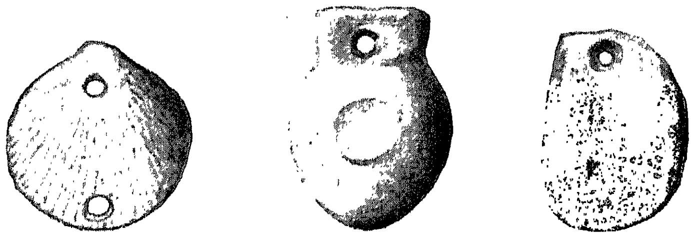


Fig. 43.—*Drawing of a horse on portion of reindeer-horn from Kesserloch* ($\frac{1}{1}$).

needles, drawings, and sculptures occurred only in the uppermost parts of the relic-bed."

Among the stray ornaments left by the inhabitants of this strange abode are sketches of animals (Figs. 42 and 43) incised on reindeer-horn, perforated teeth

of various animals, pendants made of coal (Figs. 45 and 46), and a perforated shell (*Pectunculus*). The portion of horn on which the figure of the horse is carved (Fig. 43)



Figs. 44, 45, 46.—*A perforated shell and hanging ornaments made of coal from Kesserloch* (½).

had at one end a round perforation about an inch in diameter. The following is the tabular list of objects which Mr Merk gives as the result of his excavations :—

Flint-flakes	12,000
Pebbles used as hammers	200
Fragments of worked reindeer-horn	100
Arrow-heads	55
Lance-heads without a furrow	93
Lance-heads with a furrow	40
Curved lance-heads	6
Harpoons	8
Scrapers	16
Worked ribs	3
Awls or piercers	3
Needles	12
Undetermined implements	7
Pieces of coal worked and unworked	60
Bone earrings	3
Perforated teeth	5
Coal or jet earrings (Figs. 45 and 46)	3
Worked shells and ammonites	4
Bones with one or two perforations	27
Drawings of heads	3
Drawings of animals	8
Sculptures	2

But it is not by reviews that the mists, which still hover about the fate of Palæolithic man in Europe, can be dispelled. What is now required is practical research under skilled observers. By his interesting discoveries at Mas-d'Azil, M. Piette has carried the torch of light a step further, and that, too, in a direction which promises good results in the near future.

General Remarks.

On the supposition that Man is descended from one of the higher vertebrates by a process of natural development, it necessarily follows that he must have passed through a series of physical changes which connected him with the generic stock by a continuous chain. Hence one of the primary problems which anthropologists had to consider was to ascertain if these connecting links had left any traces behind them which could throw light on the remarkable transformation he had undergone. It is for this reason that the fossil remains of man have occupied such a prominent place in these discussions. But no sooner had a fair start been made in this investigation than the entire class of evidence became partly discredited by the eagerness of its own votaries. Not content to rear, slowly and cautiously, a substantial structure on a basis of solid facts, they, in their haste, admitted into their argument materials of a more or less problematical character, which, when subjected to the strain of criticism, at once gave way. To this category must be relegated the facts hitherto advanced

in support of the existence of Tertiary man—a question which has so largely occupied the attention of French anthropologists. M. de Mortillet devotes not less than a sixth part of his book, 'Le Préhistorique,' to the consideration of "l'homme tertiare," and goes so far as to give him a generic name (*Anthropopithecus*). But it is unnecessary to analyse the facts adduced to prove the existence of this "precurseur de l'homme," as their argumentative value is questionable. Indeed, M. de Mortillet acknowledges that it is by pure reasoning he has arrived at this conclusion; but, for this very reason, he ranks it among the greatest discoveries of the age, and exclaims (p. 104): "Cela rappelle Leverrier découvrant, sans instrument, rien que par le calcul, une planète. Cela rappelle les linguistes découvrant aussi les Aryens rien que par des données de linguistique."

The only fact bearing on the probable origin of man in the tertiary period which strikes me as worth mentioning is that, in cranial development, the simian races of to-day appear to have made no advance on those of the Pliocene period. This has been shown by the facial and cranial characters of *Mesopithecus Pentelici*, found at Pikermi, at the foot of Mount Pentelicus, in Greece. The lower jaw of *Dryopithecus Fontani*, also, according to M. Albert Gaudry,[1] approaches nearer to that of man than do those of the present anthropoid apes. This is what might be expected, as, between man and the higher apes, there

[1] Les Enchainements du Monde animal dans les temps géologiques, p. 236.

is no field of existence for an intermediate being. He must compete either on brute principles or on those evolved by human ingenuity. Since man discovered, and rapidly monopolised, the principles of intelligence and mechanical appliances, there was only one platform for the successful struggle for existence; and during this period, not only have apes remained stationary, or perhaps retrograded, but many of the less progressive human races have fallen into the background and died out. Thus the gap between civilised man and brute creation has widened at both ends by the progressive development of the former, on the one hand, and the degeneration of the latter, on the other. The demand to produce the "missing links" of this transformation derives its plausibility from ignorance. That any trace of such links would remain to this day is due to a mere accident in nature. How rarely do the conditions occur which preserve the body of a land animal for centuries; and should they occasionally take place, how small is the chance of finding the fossilised remains of those animals at the present time. Fossil monkeys have been found in considerable numbers in Miocene and Pliocene deposits in Greece, France, and England. This indicates that such animals were comparatively numerous in those ages, and that the climate was then much milder than that which now obtains in the corresponding latitudes in Europe.

Palæontological researches, with, perhaps, the exception of Dr Dubois' discoveries in Java (see Chap. iii.), have not sensibly altered the question of man's relation-

ship with the lower animals since 1864, when Professor Huxley summed up the problem as follows :—

That the Neanderthal skull exhibits the lowest type of human cranium at present known, so far as it presents certain pithecoid characters in a more exaggerated form than any other; but that, inasmuch as a complete series of gradations can be found among recent human skulls, between it and the best developed forms, there is no ground for separating its possessor specifically, still less generically, from *Homo sapiens*. At present, we have no sufficient warranty for declaring it to be either the type of a distinct race or a member of any existing one; nor do the anatomical characters of the skull justify any conclusion as to the age to which it belongs.[1]

But the difficulty of discovering and correctly interpreting the phenomena of fossil man is a poor apology for the readiness with which anthropologists have admitted into their speculations so many doubtful data. On the other hand, it seems that no amount of evidence can eradicate the rooted objections of some to the doctrine of evolution. As a comment on the disputations of earlier years, on the supposed simian characters of the Neanderthal and Canstadt skulls, I may quote the following remarks by Professor Virchow, announcing the conclusion to which a congress of anthropologists, held four years ago at Ulm, came in regard to these two skulls :—

Les objets de la paléo-anthropologie sont si rares et pour la plupart si douteux que jusq'ici la tentative de la description de la race la plus ancienne de l'homme quaternaire dépasse les forces de la science. En Europe, nous avons eu deux exemples bien décourageants: ceux du crâne de Canstatt et du crâne du

[1] Natural History Review, 1864, p. 443.

Néanderthal, qui ont été regardés par des savants éminents comme ayant appartenu aux ancêtres directs de la race Européenne primitive. Il y a quinze jours, au Congrès des anthropologues allemands, à Ulm, nous avons discuté la question soulevée à propos de ces deux pièces, et nous avons trouvé que le crâne de Canstatt n'appartient pas à l'époque quaternaire, et que le crâne de Néanderthal est pour le moins très loin d'avoir une forme typique.[1]

On what grounds the Ulm congressists founded their objections I do not know; but it seems to me that it was in defiance of all scientific methods and rules of correct reasoning that the Canstadt skull had ever been adopted as a racial type, although the probability of its having been a genuine palæolithic fossil is now stronger than formerly. The facts of its discovery are as follows: In the year 1700, the then Duke of Wurtemberg excavated a Roman oppidum in the neighbourhood of Stuttgart, in the course of which a large quantity of bones, including those of quaternary animals, was dug up and preserved in the Duke's Museum. A hundred years later a human jaw was found among these bones, and on this discovery being brought under the notice of Cuvier he declined to regard it as of any value, owing to the entire absence of information as to its position in the earth. In 1835 Mr Jaeger found in the same collection portion of a human cranial vault, and brought this fact forward as an argument in favour of the co-existence of man with the extinct mammals.

Sir Charles Lyell accepted many of the speculations founded on this kind of evidence. Nor is it alone on such grounds that his accuracy has been called in ques-

[1] Congrès International, &c., à Moscou, 1892, vol. ii. p. 224.

tion. A human jaw found by Professor Crahay, near Maestricht, and known as the "Smeermaas mâchoire," was described by Sir Charles as coeval with a mammoth tusk disinterred "6 yards removed from the human jaw in horizontal distance."[1] Now, however, it is proved that the tusk was 24 feet deeper than the skull, and that the latter was merely a relic from a crannog of the Neolithic period since discovered and investigated. An epitome of the evidence on which this prosaic conclusion has been arrived at will be found in my work on the 'Lake-Dwellings of Europe,' pp. 305, 306.

These cursory remarks give but a faint idea of the interesting and profound problems embraced by the science of anthropology. The earlier portion of the period covered by them is destined to be for ever memorable in the history of mankind and civilisation. Not, since the material world became an object of human study and reflection, has there been accomplished, in so short a time, such a complete and far-reaching revolution in current philosophical opinion—a revolution whose effects are not confined to anthropology alone, but permeate every department of knowledge. From the standpoint of evolution, the entire organic world reveals a unity, a harmony, and a grandeur never before reached under any system of speculative philosophy.

[1] Antiquity of Man, 3d ed., p. 339.

CHAPTER II.

ON THE RELATION BETWEEN THE ERECT POSTURE AND THE PHYSICAL AND INTELLECTUAL DEVELOPMENT OF MAN.

(Being the Presidential Address to the Anthropological Section of the British Association at Nottingham, 1893.)

Definition of Anthropology—Advantages of the Erect Posture—Anatomical Changes consequent thereon—Evolution of the Hands and Feet—Relation between Mental Phenomena and Brain-substance—The Supernatural in Evolution—Views of Huxley and Wallace—Fallacy of comparing different Brain-capacities—Starting-point of the higher Brain-development of Man—Summary Review of the Argument.

THE science of anthropology, in its widest sense, embraces all the materials bearing on the origin and history of mankind. These materials are so comprehensive and diversified, both in their character and methods of study, that they become necessarily grouped into a number of subordinate departments. From a bird's-eye point of view, however, one marked line of demarcation separates them into two great divisions, according as they relate to the structure and functions of man's body or to the works he has produced—a classification well defined by the words *Anthropology* and *Archæology*. The former, in its limited acceptation,

deals more particularly with the development of man —his physical peculiarities, racial distinctions, linguistic manifestations, mental endowments, and, in short, every morphological or mental modification he has undergone amidst the ever-changing phenomena of his environments. The latter, on the other hand, takes cognisance of man merely as a handicraftsman. During his long journey in past time he has left behind him, scattered on the highways and byways of primeval life, numerous traces of his ways, his works, his culture, and his civilisation, all of which fall to be collected, sorted, and interpreted by the skilled archæologist. In their general aspects and relationship to each other most of the leading subjects in both these branches of the science have already been expounded, in the presidential addresses of my predecessors, by men so distinguished in their respective departments that they have left little to be said by any one who attempts to follow in their footsteps. There is, however, one phase in the progressive career of man which has not hitherto been so fully illustrated as the subject appears to me to merit. I refer to the direct and collateral advantages which the Erect Posture has conferred on him; and to this I will now briefly direct your attention, concentrating my observations successively on the following propositions:—

1. The mechanical and physical advantages of the erect posture.
2. The differentiation of the limbs into hands and feet.
3. The relation between the more perfect condition of these organs and the development of the brain.

Direct Advantages of the Erect Posture.

In the process of organic evolution it would almost appear as if Nature acted on teleological principles, because many of her products exhibit structures which combine the most perfect adaptation of means to ends along with the greatest economy of materials. This is well exemplified in some of the structural details of the organs of locomotion in which many of the so-called mechanical powers may be seen in actual use. The primary object of locomotion was to enable the organism to seek its food over a larger area than was attainable by a fixed position. The acquisition of this power was manifestly so advantageous to animal life, that the principles by which it could be effected became important factors in natural selection. I need not here dwell on the various methods by which this has been accomplished in the lower forms of life, but proceed at once to point out that in the higher vertebrates the problem resolved itself into the well-known mechanism of four movable limbs, capable of supporting and transporting the animal. As these quadrupedal animals became more highly differentiated, in virtue of the necessities of the struggle for life and the different and ever-varying conditions of their surroundings, it followed that the limbs became also modified so as to make them suitable, not only for locomotion in various circumstances, but also useful to the animal economy in other ways. Hence they were subjected to an endless variety of secondary influences, which finally adapted them for such diverse purposes as swimming, flying, climbing,

grasping, &c. The anterior limbs, owing to their proximity to the head, were more frequently selected for such transformations, as may be seen, for instance, in the wings of a bird. But whatever modifications the fore limbs may have undergone, no animal, with the exception of man, has ever succeeded in divesting them altogether of their primary function. This exceptional result was due to the erect posture, which necessitated a complete division of labour as regards the functions of the limbs — the anterior being henceforth entirely restricted to manipulative and prehensile purposes, and the posterior to locomotion. Coincident with this notable specialisation of their functions a new field for advancement was opened up to man, in which intelligence and mechanical skill became the leading factors in his further development.

Man is thus distinguished from all other animals by the fact that, in the normal attitude of walking or running, he carries his body upright—*i.e.*, with the axis of the vertebral column perpendicular, instead of horizontal or oblique. In this position all its parts are so arranged as to require a minimum amount of exertion in the performance of their functions. Should any of the other higher vertebrates ever assume an erect attitude it can only be maintained temporarily, and its maintenance involves an additional expenditure of force. In a certain sense a bird may be looked upon as a biped; but there is this distinction to be drawn between it and man—viz., that the former has not only its body balanced obliquely on its two legs, but also its fore limbs converted into special organs for motion in the air.

The anthropoid apes hold an intermediate position, and so carry their body in a semi-erect attitude. But this shortcoming in reaching the perfectly upright position, however slight it may be in some of these animals, represents a wide gap which can only be fully appreciated by a careful study of the physiological and psychological phenomena manifested in their respective life-functions.

Every one acquainted with the ordinary operations of daily life knows how much labour can be saved by attention to the mere mechanical principles involved in their execution. In carrying a heavy load, the great object is to adjust it so that its centre of gravity comes as nearly as possible to the vertical axis of the body, as otherwise force is uselessly expended in the effort to keep the entire moving mass in stable equilibrium—a principle well exemplified by the Italian peasant girl when she poises her basket of oranges on her head. Once upon a time a powerful waterman, accustomed to use buckets double the size of those of his fellow-watermen, had the misfortune to have one of them broken. As he could not, then and there, get another bucket to match the remaining one, and wishing to make the best possible use of the appliances at hand, he replaced the broken vessel by one half its size. He then filled both with water and attempted to carry them, as formerly, attached to a yoke, one on each side of him. But to his astonishment this arrangement would not work. The yoke became uneven, and the effort to keep it balanced on his shoulders was so troublesome that he could not proceed. This emergency led

to serious reflection, but, after some experimental trials, he ascertained that, by merely making the arm of the yoke on which the small bucket was suspended double the length of the other, he could carry both buckets without inconvenience.

But let me take one other illustration. Suppose that two burglars have concocted a plan to rob a richly stored mansion by getting access to its rooms through the windows of an upper storey. In order to carry out this design they secure a ladder, easily transported by the two together, though too heavy for one. So, bearing the ladder between them, one at each end, they come to the house. After a considerable amount of exertion they succeed in placing the ladder in an upright position against the wall, and then one of the men mounts its steps and enters the house. The man left outside soon realised that, once the ladder was balanced perpendicularly, he himself could then easily control it. Moreover, he made the discovery that by resting its weight on each leg alternately, he could gradually shift its position from one window to another. Thus there was no interruption or limit to the extent of their depredations. Experience quickened their perceptions, and ultimately they became adepts in their respective departments—the one in the art of moving the ladder, and the other in the science of the nimble-fingered gentry. The division of labour thus practised by these two men accurately represents what the attainment of the erect posture has accomplished for man by setting free his upper limbs from any further participation in the locomotion of his body.

The continued maintenance of this unique position necessitated great changes in the general structure of the body. The solution of the problem involved the turning of the ordinary quadruped a quarter of a circle in the vertical plane, thus placing the axis of the spine perpendicular, and consequently in line with the direction of the posterior limbs; and to effect this, the osseous walls of the pelvis underwent certain modifications, so as to bear the additional strain put upon them. The stability of the trunk in its new position was effected by the development of special groups of muscles, whose powerful and combined actions give to the movements of the human body their characteristic freedom and gracefulness. The lower limbs were placed as widely apart as possible at their juncture with the pelvis, and the thigh- and leg-bones were lengthened and strengthened so as to be capable of supporting the entire weight of the body, and of transporting it with due efficiency when required. The spinal column assumed its well-known curves, and the skull, which formerly had to be supported by a powerful muscle attached to the spinous processes of the cervical vertebræ (*ligamentum nuchæ*), moved backwards until it became nearly equipoised on the top of the vertebral column. The jaws also receded, and the frontal eminence became more prominent, so that the face ultimately assumed a less prognathic appearance. The upper limbs, instead of taking part in their original function of locomotion, were now themselves carried as flail-like appendages of the human mechanism, in order to give them as much freedom and range of action as possible. The

shoulder-blades receded to the posterior aspect of the trunk, having their axes at right angles to that of the spine. Further, like the haunch-bones, they underwent certain modifications, so as to afford points of attachment to the muscles required in the complex movements of the arms. In the pendulous position each arm has its axis at right angles to that of the shoulder, but by a common muscular effort the two axes can be readily brought into line. The elbow-joint became capable of performing the movements of complete extension, flexion, pronation, and supination—in which respects the upper limb of man is differentiated from that of all other vertebrates.

Evolution of the Human Hand and Foot.

But it is in the distal extremities of the limbs that the most remarkable anatomical changes have to be noted. The foot is virtually a tripod, the heel and the ball of the great toe being the terminal ends of an arch, while the four outer digital columns group themselves together to form the third, or steadying, point.[1]

[1] In an appreciative letter which I had the honour of receiving from the late Professor Huxley in regard to this address, he makes the following comments on my description of the human foot:—

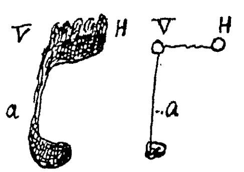


Fig. 47.—*Impression of a wet foot, showing connecting bars of the so-called tripod.*

"If you should throw your address into any other shape, let me ask you to consider a point in relation to the foot which I think worth your attention. The statement on page 94 is not quite exact. If you will take your foot out of the water of the matutinal tub and put it on the dry floor, standing quite upright, you will see that the mark made is of this shape (fig. 47), that is to say, a long narrow impression (a) is made by the outer

The outer toes thus play but a subordinate part in locomotion, and, as their prehensile function is no longer of use, they may be said to be fast approaching to the condition of rudimentary organs. The three osseous prominences which form this tripod are each covered with a soft elastic pad, which both facilitates progression and acts as a buffer for deadening any possible shock which might arise in the course of running or leaping. The chief movement in the act of progression is performed by an enormously developed group of muscles known as the calf of the leg, so characteristic of man. The walker is thereby enabled to use the heel and the ball of the great toe as successive fulcrums from which the forward spring is made, the action being greatly facilitated by that of the trunk muscles in simultaneously bending the body forwards. The human foot is thus admirably adapted to be both a pillar for supporting the weight of the body and a lever for mechanically impelling it forwards. Hence the amount of energy expended in progression is reduced to a minimum, and when estimated proportionally to the size of the body it is believed to be considerably less than that requisite for the corresponding act in quadrupeds.

edge of the foot, which normally always rests on the ground, as in the ape's.

"The arched foot—hypothetical, I believe—of aristocracy issued in a deformity. So that the 'tripod' has an outer bar (*a*) as well as a front bar. The ape's foot is, on this point, made human by padding under hallux, as well as enlarging the latter and bringing the metatarso-phalangeal point down.

"The arboreal twist so remarkable in the new-born child—I have often pointed it out to the extreme disgust of proud mothers—never really disappears."—Extract from a letter by Prof. Huxley, dated Nov. 26, 1893.

The anatomical changes effected in the extremity of the upper limb are equally radical, but of a totally different character and scope. Here we have to contemplate the transformation of the same homologous parts into an apparatus for performing a series of prehensile and manipulative actions of the most intricate character, but among which neither locomotion nor support of the body forms any part whatever. This apparatus is the human hand, the most complete and perfect mechanical organ nature has yet produced. The fingers have become highly developed, and can be opposed singly or in groups to the thumb, so as to form a hook, a clasp, or a pair of pincers; and the palm can be made into a cup-shaped hollow, capable of grasping a sphere. Nor is there any limit to the direction in which many of these manipulations can be performed without any movement of the rest of the body. For example, a pencil held by the thumb and the two forefingers, as in the act of writing, can be placed in all the directions of space by a mere act of volition, acting through the muscles of the forearm alone.

The position of such a perfect piece of mechanism at the extremity of a movable arm attached to the upper part of the trunk, gives to man a superiority in attack and defence over all other animals, on the same principle as a soldier finds it advantageous to fight from higher ground. Moreover, he possesses the power to perform a variety of quick movements, and to assume attitudes and positions eminently adapted for the exercise of that manipulative skill with which he counteracts the superior brute force of many of his antagonists.

He can readily balance his body on one or both legs, can turn on his heels as if they were pivots, and can prostrate himself comfortably in the prone or supine positions. As the centre of gravity of the whole body is nearly in line with the spinal axis, stable equilibrium is easily maintained by the lumbar muscles. Altogether we have in his physical constitution a combination of structures and functions sufficiently unique in its *tout-ensemble* to place man in a category by himself. But, at the same time, we must not forget that all his morphological peculiarities have been brought about without the destruction of any of the primary and typical homologies common to all the higher vertebrates.[1]

[1] Professor Cleland has kindly permitted me to quote the following remarks bearing on this point from his paper on "Terminal Forms of Life": "Man is the only animal who is maintained by balance in the upright posture and supported on straightened knees. The arch of the instep is peculiar to him, and the whole lower limb is modified, and also the trunk; while the head is adapted to the balanced position by changes necessitated in its proportions as containing the developed organ of thought, the brain, and bearing the face modified as the special organ of the expression of thought. By the elevation into the upright posture the symbolism in the position of the great nervous centre is carried a step further, the brain assuming the uppermost place, while the shortened spinal cord is thrown behind. More important, perhaps, in the eyes of matter-of-fact persons is the circumstance that the proportions of the parts of the brain are totally different in man from those of the brains of the highest apes, there being an enormous development of the hemispheres or portion of the brain specially connected with thought, leaving a gap between the apes and the lowest human brain much greater than between the lower and higher races of men—a gap, moreover, altogether unbridged —while the differences of human brains are graduated so that there is no link wanting. But, further, the development of the brain is in connection with a whole system of development of the head and face which cannot be carried further than in man. For the mode in which the cranial cavity is gradually increased in size is a regular one, which may be explained thus: we may look on the skull as an irregular cylinder, and at the same time that it is expanded by increase of height and width it also undergoes a curvature or bending on itself, so that the base is crumpled together while

The Relation between Mental Phenomena and the Brain.

Turning now to the brain, the undoubted organ of the mind, we find, in its intellectual and psychical manifestations, a class of phenomena which gives to man's life-functions their most remarkable character. However difficult it may be for our limited understanding to comprehend the nature of conscious sensation, we are forced to the conclusion that the act invariably takes place through the instrumentality of a few nerve-cells, whose functional activity requires to be renovated in precisely the same manner as the muscular force expended in walking. The aggregation of such cells into ganglia and nerves, by means of which reflex action, consciousness, and a variety of psychical phenomena take place, is found to permeate, in a greater or less degree, the whole of the organic world. In the higher vertebrates the seat of these manifestations is almost exclusively confined to an enormous collection of brain-substance placed at the upper end of the vertebral

the roof is elongated. This curving has gone on in man till the fore end of the cylinder, the part on which the brain rests above the nose, is nearly parallel to the aperture of communication of the skull with the spinal canal—*i.e.*, the cranium has a curve of 180°, or a few degrees more or less. This curving of the base of the skull involves change in position of the face bones also, and could not go on to a further extent without cutting off the nasal cavity from the throat. The projection of the muzzle, which has hitherto occurred in connection with jaws for seizing hold of food, disappears, only a vestige remaining in savages; and there would be neither beauty nor functional advantage in any further retreat of the face under the skull than is represented in classic statuary. Thus, you see, there is anatomical evidence that the development of the vertebrate form has reached its limit by completion in man."—Journal of Anatomy and Physiology, vol. xviii. p. 360.

column, and encased in a complete osseous covering called the skull. We learn from numerous experimental researches, carried out by physiologists in recent years, that the brain is a dual organ, consisting of a double series of distinct ganglia and connected to some extent by a complex system of nervous tissues, not only with each other, but with the central seat of consciousness and volition. But the difficulty of determining the nature of its functions, and the *modus operandi* of its psychological manifestations, is so great that I must pass over this part of the subject very lightly indeed. The conditions of ordinary reflex action require that a group of muscles, by means of which a particular bodily movement is effected, shall be connected with its co-ordinating ganglion by an afferent and an efferent system of nerves. Impressions from without are conveyed by the former, or sensory nerves, to the central ganglion, from which an impulse is retransmitted by the motor nerves which sets in operation the muscular force for producing the required movement. But this efferent message is, in many cases, absolutely controlled by volition, and not only can it prevent the muscular action from taking place, but it can effect a similar movement, *de novo*, without the direct intervention of external impressions at all. Now, it has been proved experimentally that the volitional stimulus, which regulates the various movements of the body, starts from definite portions of the brain according to the different results to be produced. This localisation of brain functions, though still far from being thoroughly understood, comes very appropriately into

use in this inquiry. From it we learn that the homology, which characterises the structural elements of the bodies of animals, extends also to the component parts of their respective brains. The law which differentiates animals according to the greater specialisation of the functions of their various organs has its counterpart in the brain, and we, therefore, naturally expect an increase of brain-substance in every case in which the functional activity of a specific organ is extended. Thus the act of stitching with a needle and thread, an act beyond the mental and physical capacity of any animal but man, would entail a certain increase of brain-substance, simply in obedience to the great complexity of the movements involved in its execution, over and above that which may be supposed to be due to the intellectual and reasoning faculties which invented it.

That man's brain and his intelligence are correlated to each other is a fact too axiomatic to require any demonstration; nor can it be doubted that the relationship between them is of the nature of cause and effect. But to maintain that the amount of the latter is directly proportional to the size of the former is rather straining the laws of legitimate inference. In drawing any general conclusion of this nature from the bulk of brain-substance, there are some modifying influences which cannot be disregarded, such, for example, as the amount of cranial circulation and the quality of the brain-cells. But the determination of this point is not the exact problem with which the evolutionist is primarily concerned. To him the real

crux in the inquiry is to account for the evolution of man's comparatively large brain under the influence of existing cosmic forces. After duly considering this problem, and casting about for a possible explanation, I have come to the conclusion that not only is it the result of natural laws, but that one of the main factors in its production was the conversion of the upper limbs into true hands. From the first moment that the being recognised the advantage of using a club or a stone in attacking his prey, or defending himself from his enemies, the direct incentives to a higher brain-development came into existence. He would soon learn by experience that a particular form of club or stone was more suitable for his purposes; and if the desiderated object were not to be found among the natural materials around him, he would proceed to manufacture it. Certain kinds of stones would be readily recognised as better adapted for cutting purposes than others, and he would select his materials accordingly. If these were to be found only in a special locality, he would visit that locality whenever the prized material was needed. Nor would it be an unwarrantable stretch of imagination to suppose that the circumstances would lead him to lay up a store for future use. These simple acts of intelligence assume little more than may be seen in the actions of many of the lower animals. Consciousness of his power to make and to wield a weapon was a new departure in the career of man, and every repetition of such acts became an effective and ever-accumulating training force. What a memorable event in the history of humanity was the manu-

facture of the first sharp stone implement! Our sapient ancestor, who first used a spear tipped with a sharp flint, became possessed of an irresistible power over his fellow-creatures. The invention of the bow and arrow may be paralleled with the discovery of gunpowder and the use of cannon, both of which revolutionised the principles of warfare in their respective ages. The art of fire-making had a greater influence on human civilisation than the modern discovery of electricity. The first boat was in all probability a log—an idea which might have been suggested by the sight of an animal clinging to a floating piece of wood carried away by a flood. To scoop this log into a hollow was an after-thought. The successive increments of knowledge by which a single-tree canoe has been transformed into a first-class Atlantic liner are scattered through the unwritten and written annals of many ages. In his expeditions for hunting, fishing, fruit-gathering, &c., primitive man's acquaintance with the mechanical powers of nature would be gradually extended, and *pari passu* with the increasing range of knowledge there would be a corresponding development in his reasoning faculties. Natural phenomena suggested reflections as to their causes and effects, and so by degrees they were brought into the category of law and order. Particular sounds would be used to represent specific objects, and these would become the first rudiments of language. Thus each generalisation when added to his previous little stock of knowledge widened the basis of his intellectual powers. As the process progressed man would acquire some

notion of the abstract ideas of space, time, motion, force, number, &c.; and continuous thought and reasoning would ultimately become habitual to him. All these mental operations could only take place through the medium of additional nerve-cells, and hence the brain gradually became more bulky and more complex in its structure. Thus the functions of the hand and of the brain have been correlated in a most remarkable manner. Whether the mechanical skill of the hand preceded the greater intelligence of the brain, or *vice versa*, it is impossible to say, as between the two there must have been a constant interchange of gifts. According to Sir C. Bell, "the hand supplies all instruments, and by its correspondence with the intellect gives him universal dominion."[1]

That mind, in its higher psychical manifestations, has sometimes been looked upon as a spiritual essence which can exist separately from its material basis need not be wondered at when we consider how the pleasing abstractions of the poet, or the fascinating creations of the novelist, roll out, as it were, from a hidden cavern without the slightest symptom of physical action. It is this marvellous power of gathering and combining ideas, previously derived through the ordinary senses, which gives a *primâ facie* appearance of having here to deal with a force exterior to the brain itself. But, indeed, it is questionable if such psychological phenomena are really represented by special organic equivalents. May they not be due rather to the power of volitional reflection which summons ideas

[1] The Hand, &c. Bridgewater Treatise, p. 38.

from the materials stored up by the various localised portions into which the brain is divided? From this point of view there may be many phases of pure cerebration which, though not the result of direct natural stimulants from without, have nevertheless as physical an origin as conscious sensation. Hence, imagination, conception, idealisation, the moral faculties, &c., may be aptly compared to parasites which live at the expense of their neighbours. After all, the greatest mystery of life lies in the simple acts of conscious sensation, and not in the higher mental combinations to which they give origin. The highest products of intellectuality are nothing more than the transformation of previously existing energy derived, in the first place, through the ordinary senses in the same way as by other animals; and it is the power to utilise it in this exceptional manner—*i.e.*, to other purposes besides mere animality—that alone requires a special organic equivalent in the brain.

Supernatural Intelligence and Mental Evolution.

But this brings us on controversial ground of the highest importance. Professor Huxley thus expresses his views on the phase of the argument now at issue:—

"I have endeavoured to show that no absolute structural line of demarcation, wider than that between the animals which immediately succeed us in the scale, can be drawn between the animal world and ourselves; and I may add the expression of my belief that the attempt to draw a psychical distinction is equally futile,

and that even the highest faculties of feeling and of intellect begin to germinate in lower forms of life."[1]

On the other hand, Mr Alfred R. Wallace, who holds such a distinguished position in this special field of research, has promulgated a most remarkable theory. This careful investigator, an original discoverer of the laws of natural selection, and a powerful advocate of their adequacy to bring about the evolution of the entire organic world, even including man up to a certain stage, believes that the cosmic forces are insufficient to account for the development of man in his civilised capacity. "Natural selection," he writes, "could only have endowed savage man with a brain a few degrees superior to that of an ape, whereas he actually possesses one very little inferior to that of a philosopher." This deficiency in the organic forces of nature he essays to supply by calling in the guiding influence of a "superior intelligence." In defending this hypothesis from hostile criticism he explains that by "superior intelligence" he means some intelligence higher than the "modern cultivated mind," something intermediate between it and Deity. But as this is a pure supposition, unsupported by any evidence, and merely a matter of personal belief, it is unnecessary to discuss it further. I would just, *en passant*, ask Mr Wallace why he dispenses with this "higher intelligence" in the early stages of man's evolution, and finds its assistance only requisite to give, as it were, the final touches to humanity?

In dealing with the detailed objections raised by Mr

[1] Evidences as to Man's Place in Nature, p. 109.

Wallace against the theory of natural selection as applied to man, we are, however, strictly within the sphere of legitimate argument; and evolutionists are fairly called upon to meet them. As his own theory is founded on the supposed failure of natural selection to explain certain specified peculiarities in the life of man, it is clear that if these difficulties can be removed, *cadit quæstio*. It is only one of his objections, however, that comes within the scope of my present inquiry—viz., that which is founded on the supposed "surplusage" of brain-power in savage and prehistoric races.

In comparing the brains of the anthropoid apes and man Mr Wallace adopts the following numbers to represent their proportional average capacities, viz., anthropoid apes 10, savages 26, and civilised man 32—numbers to which there can be no objection, as they are based on data sufficiently accurate for the requirements of this discussion. In commenting on the mental ability displayed in actual life by the recipients of these various brains he states that savage man has "in an undeveloped state faculties which he never requires to use," and that his brain is much beyond his actual requirements in daily life. He concludes his argument thus: "We see, then, that whether we compare the savage with the higher developments of man or with the brutes around him, we are alike driven to the conclusion that in his large and well-developed brain he possesses an organ quite disproportionate to his actual requirements — an organ that seems prepared in advance, only to be fully utilised as he progresses in civilisation. A brain one-half larger than that of the

gorilla would, according to the evidence before us, fully have sufficed for the limited mental development of the savage; and we must therefore admit that the large brain he actually possesses could never have been solely developed by any of those laws of evolution whose essence is that they lead to a degree of organisation exactly proportionate to the wants of each species, never beyond those wants; that no preparation can be made for the future development of the race; that one part of the body can never increase in size or complexity, except in strict co-ordination to the pressing wants of the whole. The brain of prehistoric and of savage man seems to me to prove the existence of some power distinct from that which has guided the development of the lower animals through their ever-varying forms of being."[1]

With regard to the closing sentence of the above quotation, let me observe that the cosmic forces under which the lower animals have been produced by means of natural selection do not disclose, either in their individual or collective capacity, any guiding power in the sense of a sentient influence; and I believe that the "distinct power" which the author summons to his aid, apparently from the "vasty deep," to account for the higher development of humanity, is nothing more than the gradually acquired product of the reasoning faculties themselves. Not that, for this reason, it is to be reckoned less genuine and less powerful in its operations than if it had emanated from an outside source. The reasoning power displayed by man is virtually a

[1] Natural Selection, &c., 1891, p. 193.

higher intelligence, and, ever since its appearance on the field of organic life, it has, to a certain extent, superseded the laws of natural selection. Physical science has made us acquainted with the fact that two or three simple bodies will sometimes combine chemically so as to produce a new substance, having properties totally different from those of either constituents in a state of disunion. Something analogous to this has taken place in the development of man's capacity for reasoning by induction. Its primary elements, which are also those of natural selection, are conscious sensation, heredity, and a few other properties of organic matter,—elements which are common, in a more or less degree, to all living things. As soon as the sequence of natural phenomena attracted the attention of man, and his intelligence reached the stage of consecutive reasoning on the invariableness of certain effects from given causes, this new power came into existence; and its operations are, apparently, so different from those of its component elements that they can hardly be recognised as the offspring of natural forces at all. Its application to the adjustment of his physical environments has ever since been one of the most powerful factors, not only in the development of humanity, but in altering the conditions and life-functions of many members of the animal and vegetable kingdoms.

I have already pointed out that the brain can no longer be regarded as a single organ, but rather as a series of organs connected by bonds of union—like so many departments in a Government office in telephonic communication—all, however, performing special and

separate functions. When, therefore, we attempt to compare the brain-capacity of one animal with that of another, with the view of ascertaining the quality of their respective mental manifestations, we must first determine what are the exact homologous parts that are comparable. To draw any such inference from a comparison of two brains, by simply weighing or measuring the whole mass of each, would be manifestly of no scientific value. For example, in the brain of a savage the portion representing highly skilled motor energies might be very much larger, while the portion representing logical power might be smaller, than the corresponding parts in the brain of a philosopher. But should these inequalities of development be such as to balance each other, the weight of the two organs would be equal. In this case what could be the value of any inference as to the character of their mental endowments? Equal-sized brains do not display equivalent, nor indeed analogous, results. To postulate such a doctrine would be as irrational as to maintain that the walking capacities of different persons are directly proportional to the weight of their bodies. Similar remarks are equally applicable to the skulls of prehistoric races, as it would appear that evolution had done the major part of its work in brain-development long before the days of neolithic civilisation. Huxley's well-known description of the Engis skull—"a fair average skull, which might have belonged to a philosopher, or might have contained the thoughtless brains of a savage"—goes far to settle the question from its anatomical point of view. Until localisation of brain-func-

tions makes greater progress it is, therefore, futile to speculate to any great extent on the relative sizes of the skulls of different races either in present or prehistoric times.

But there is another aspect of the question which militates against Mr Wallace's hypothesis — viz., the probability that many of the present tribes of savages are, in point of civilisation, in a more degenerate condition than their forefathers who acquired originally higher mental qualities under natural selection. There must surely be some foundation of truth in the widely spread tradition of the fall of man. And, if such be the case, we naturally expect to find some stray races with inherited brains of greater capacity than their needs, in more degenerate circumstances, may require.[1]

[1] That mental exercise increases brain-substance is as certain as that physical exercise increases muscular tissue; but in the former case the process is much slower than in the latter. We have ample testimony that a higher civilisation, acquired through the experience and struggles of centuries, cannot be suddenly engrafted on the lower races of mankind; nor yet on higher races who have subsequently reverted to a lower grade of civilisation. On the latter point we have the unequivocal evidence of Professor Flinders Petrie. "Let us," says he, "turn now to our attempts on a higher race, the degenerated and Arabised descendants of a great people, the Egyptians. Here there is much ability to work on, and also a good standard of comfort and morality, comfortable to our notions. Yet the planting of another civilisation is scarcely to be borne by them. The Europeanised Egyptian is in most cases the mere blotting-paper of civilisation, absorbing what is most superficial and undesirable. . . . Such a result is only what is to be expected when we consider that the brain is the part of man which develops and changes as races reach a higher level, while the body remains practically constant throughout ages. To expect the brain to make sudden changes of ability would be as reasonable as to expect a cart-horse to breed racers, or a greyhound to tend sheep. Man mainly develops by internal differences in his brain-structure, as other animals develop by external differences in bones and muscles."—Address to Anthropological Section of British Association at Ipswich, 1895.

An exact equivalent to this may be seen in the feeble intellectuality of many of the peasants and lower classes among the civilised nations of modern times. Yet a youth born of such parents, if educated, often becomes a distinguished philosopher. It is well known that if an organ ceases to perform its functional work it has a tendency to deteriorate and ultimately to disappear altogether. But from experience we know that it takes a long time for the effects of disuse to become manifest. It is this persistency that accounts for a number of rudimentary organs, still to be met with in the human body, whose functional activity could only have been exercised ages before man became differentiated from the lower animals. Such facts give some support to the suggestion, previously made, that philosophy, as such, has no specially localised portion in the brain. Its function is merely to direct the current of mental forces already existing.

But, again, Mr Wallace's argument involves the assumption that the unnecessarily large brain of the savage had been constructed on teleological principles for the sole purpose of philosophising. My opinion is that the greater portion of this so-called surplusage is the organic representative of the energy expended in the exercise of the enormous complexity of human actions, as displayed in the movements of his body and in the skilful manipulations necessary to the manufacture of implements, weapons, clothing, &c. All such actions have to be represented by a larger bulk of brain-matter than is required for the most profound philosophical speculations. The kind of intelligence

evinced by savages, however low their position in the scale of civilisation may be, is different from, and incomparably greater than, that manifested by the most advanced of the lower animals. Does it not seem more rational to suppose that the development of the large brain of man corresponded, *pari passu*, with that of his characteristic physical attributes, more especially those consequent on the attainment of the upright position? That these attributes were acquired exclusively through the instrumentality of the cosmic forces was, as the following quotation will show, the opinion of Mr Darwin: "We must remember that nearly all the other and more important differences between man and quadrumana are manifestly adaptive in their nature, and relate chiefly to the erect position of man,—such as the structure of his hand, foot, and pelvis, the curvature of his spine, and the position of his head."[1] Mr Wallace, however, considers the feet and hands of man "as difficulties on the theory of natural selection." "How," he exclaims, "can we conceive that early man, *as an animal*, gained anything by purely erect locomotion? Again, the hand of man contains latent capacities and powers which are unused by savages, and must have been even less used by palæolithic man and his still ruder predecessors. It has all the appearance of an organ prepared for the use of civilised man, and one which was required to render civilisation possible."[2] But here again this acute observer diverges into his favourite by-path,

[1] Descent of Man, p. 149.
[2] Natural Selection, p. 198.

and introduces a "higher intelligence" to bridge over his difficulties.

Starting-point of the higher Brain-development of Man.

We have now reached a stage in this inquiry when a number of questions of a more or less speculative character fall to be considered. On the supposition that the evolution of the hand of man was synchronous with the starting-point of the higher development of his reasoning faculties, it is but natural to ask where, when, and in what precise circumstances this remarkable coalition took place. I would not, however, be justified in taking up your time now in discussing these questions in detail; not because I think the materials for their solution are unattainable, but because, in the present state of our knowledge, they are too conjectural to be of scientific value. In the dim retrospective vista which veils these materials from our cognisance I can only see a few faint landmarks. All the osseous remains of man which have hitherto been collected and examined point to the fact that, during the larger portion of the Quaternary period, if not, indeed, from its very commencement, he had already acquired his human characteristics. This generalisation at once throws us back to the Tertiary period in our search for man's early appearance in Europe. Another fact—disclosed by an analysis of his present corporeal structure—is that, during a certain phase of his previous existence, he passed

through a stage when his limbs, like those of the present anthropoid apes, were adapted for an arboreal life. We have, therefore, in the first place, to look for the causes which brought about the separation of man from his quadrumanous congeners, and entailed on him such a transformation in his form and habits, in the physical conditions that would supervene on a change from a warm to a cold climate. In the gradual lowering of the temperature of the subtropical climate which prevailed in Central Europe and the corresponding parts of Asia during the Miocene and Pliocene periods, and which culminated in the great Ice age, together with the concurrent changes in the distribution of land, seas, and mountains, we have the most probable explanation of these causes. Whether man forsook his arboreal habits and took to the plains from overcrowding of his own species in search of different kinds of food, or from some other unknown changes in his environments, before this cold period subjected him to its intensely adverse circumstances, it would be idle for me to offer an opinion. Equally conjectural would it be to inquire into the exact circumstances which led him to depend exclusively on his posterior limbs for locomotion.

During this early and transitional period in man's career there was no room for ethics. Might was right, whether it emanated from the strength of the arm, the skill of the hand, or the cunning of the brain. Life-and-death combats would decide the fate of many competing races. The weak would succumb to the strong, and ultimately there would survive only such

as could hold their own by flight, strength, agility, or skill, just as we find among the races of man at the present day.

Summary Review of the Argument.

In summing up these general observations, let me just emphasise the main points of the argument. With the attainment of the erect position, and the consequent specialisation of his limbs into hands and feet, the precursor of man entered on a new phase of existence. With the advantage of manipulative organs and a progressive brain he became *Homo sapiens*, and gradually developed a capacity to understand and utilise the forces of nature. As a handicraftsman he fashioned tools and weapons, with the skilful use of which he got the mastery over all other animals. With a knowledge of the uses of fire, the art of cooking his food, and the power of fabricating materials for clothing his body, he accommodated himself to the vicissitudes of climate, and so greatly extended his habitable area on the globe. As ages rolled on he accumulated more and more of the secrets of nature, and every such addition widened the basis for further discoveries. Thus commenced the grandest revolution the organic world has ever undergone — a revolution which culminated in the transformation of a brute into civilised man. During this long transitional period mankind encountered many difficulties, perhaps the most formidable being due to the internecine struggles of inimical members of their own species. In these

circumstances the cosmic processes, formerly all-powerful so long as they acted only through the constitution of the individual, were of less potency than the acquired ingenuity and aptitude of man himself. Hence local combinations for the protection of common interests became necessary, and with the rise of social organisations the safety of the individual became merged in that of the community. The recognition of the principle of the division of labour laid the foundations of subsequent nationalities, arts, and sciences. Coincident with the rise of such institutions sprung up the germs of order, law, and ethics. The progress of humanity on these novel lines was slow, but in the main steadily upwards. No doubt the advanced centres of the various civilisations would oscillate, as they still do, from one region to another, according as some new discovery gave a preponderance of skill to one race over its opponents. Thus the civilised world of modern times came to be fashioned, the outcome of which has been the creation of a special code of social and moral laws for the protection and guidance of humanity. Obedience to its behests is virtue, and this, to use the recent words of a profound thinker, "involves a course of conduct which, in all respects, is opposed to that which leads to success in the cosmic struggle for existence. In place of ruthless self-assertion it demands self-restraint; in place of thrusting aside or treading down all competitors, it requires that the individual shall not merely respect but shall help his fellows: its influence is directed, not so much to the

survival of the fittest, as to the fitting of as many as possible to survive. It repudiates the gladiatorial theory of existence. It demands that each man who enters into the enjoyment of the advantages of a polity shall be mindful of his debt to those who have laboriously constructed it; and shall take heed that no act of his weakens the fabric in which he has been permitted to live. Laws and moral precepts are directed to the end of curbing the cosmic process and reminding the individual of his duty to the community, to the protection and influence of which he owes, if not existence itself, at least the life of something better than a brutal savage."[1]

These humble remarks will convey to your minds some idea of the scientific interest and profound human sympathies evoked by the far-reaching problems which fall to be discussed in this Section. Contrasting the present state of anthropological science with its position some thirty or forty years ago, we can only marvel at the thoroughness of the change that has taken place in favour of its doctrines. Now man's immense antiquity is accepted by a vast majority of the most thoughtful men, and his place in nature, as a derivative animal at the head of the great chain of life, appeals for elucidation to all sciences and to all legitimate methods of research. But among the joyful pæans of this triumphal march we still hear some discordant notes—notes, however, which seem to me to die with their echoes, and to have as little effect on scientific progress as the whistling of an idle wind.

[1] Huxley, on Evolution and Ethics, p. 33.

For my own part, I cannot believe that a science which seeks in the spirit of truth to trace the mysteries of human life and civilisation to their primary rootlets, a science which aims at purging our beliefs of superstitious figments generated in days when scientific methods were too feeble to expose the errors on which they were founded, a science which reminds us in a thousand ways that success in life depends on a correct knowledge of the cosmic forces around us, can be opposed to the highest and most durable interests of humanity.

CHAPTER III.

NOTES ON "FOSSIL MAN."

"Fossil Man" defined—This kind of research liable to Error—The Naulette and other Human Jaws—Anthropological Importance of Skulls—Human remains from Neanderthal, Engis, Olmo, Eguisheim, Clichy, Spy, and Galley Hill—*Pithecanthropus erectus*—Classification of Skulls into Dolichocephalic and Brachycephalic—The Brünn Skeleton.

As soon as the question of Man's relationship to the organic world had forced itself into the arcana of scientific circles, in consequence of the writings of Darwin, Huxley, Lyell, and others, the evidential materials were collected so rapidly that a division of labour among working anthropologists became absolutely imperative. The first parting of the common way was at the natural bifurcation which points, on the one hand, to the handicraft products of past races, and, on the other, to the more or less fossilised fragments of their bodies which have come to light. It is with this latter department we are now specially concerned.

Definition of "Fossil Man."

Fossils are a kind of natural hieroglyphs which run *pari passu* with the various stages of organic evolu-

tion. As mere sports of fortuitous circumstances, footprints of death, as it were, on the sands of time, they were not intended either for the instruction of humanity or to be permanent records of the history of the organic world. Yet such they have become in the hands of intelligent man. A shell, a tooth, a petrified bone, or even the impression of an object long since disintegrated, often suffices to reveal the deepest mysteries of the past. Throughout the long æons during which life has existed on the globe these organic records, wherever they have been scanned by the eye of the expert, disclose the same story of recurring scenes of construction and destruction, each rising to higher ideals than its predecessor. New species were constantly appearing, while others were hustled off the stage of existence in a relentless death-struggle with their more highly equipped successors. With kaleidoscopic variableness such panoramic displays of life and death chase each other, like fleeting cloud-shadows on a landscape, throughout the entire series of geological periods. Yet the organic and physical principles which underlie them all, and even their constituent elements, are ever the same.

The expression "fossil man" may be applied to any portion of the human body which bears evidence of antiquity, but, as it is only bone that continues undecomposed for any great length of time, it practically means the skeleton in a more or less imperfect condition. As long as the object of anthropologists was merely to extend the period of Man's existence on the earth, any osseous fragment which could be labelled

human had its chronological value. But now, when it comes to be a question of the life-history of the individual or race, more than fragments are necessary. Nor is it only the inherent characters of the actual remains that have to be considered. The sequence of the deposits in which they have lain has to be determined, as well as the nature of the other associated materials—problems which often involve an appeal to the collateral sciences. To prevent error and safeguard the interests of scientific research, too much caution cannot be displayed in the selection of materials in support of such controverted problems as the origin and antiquity of Man. It is better to reject, temporarily at least, discoveries to which any reasonable objection can be raised than to expose the whole evidence to the attacks of unbelievers. I therefore discard the *Smeermaas mâchoire* for reasons stated elsewhere (p. 86); also the Canstadt skull, notwithstanding that by use and wont it has given a name to probably the earliest human race in Europe. The famous jaw of Moulin-Quignon, said to have been found in the Palæolithic gravels at Amiens[1] at a depth of 4·50$^{m.}$, is now generally regarded as a fraud. The commissioners of inquiry into its authenticity ascertained, by sawing the bone, that its interior contained "sable grisâtre qui différait complètement de la gangue noirâtre située à l'extérieur."[2] It was thus manifest that these gravels were not its original resting-place—a fact which led M. de Mortillet, contrary

1 Lyell's Antiquity of Man, 3d ed., p. 515.
2 Comptes rendus Acad. des Sciences, 1863, p. 927.

to the opinion of his fellow-countrymen, to pronounce against its genuineness.[1]

The Naulette and other Human Jaws.

But no such objection can be taken to the fragment of another human jaw (lower) found, in the year 1865, in the *Trou de la Naulette* by M. Ed. Dupont, Director of the Royal Natural History Museum of Brussels.[2] This cave, situated on the left bank of the river Lesse near Dinant, has a straight entrance-gallery terminating in a dark chamber of considerable dimensions. On the irregular floor of the chamber a mass of fluvial deposits, to the depth of 11$^{m.}$, had accumulated. The entrance at present stands 28$^{m.}$ above the bed of the river, but it was evident from the nature of the *débris* inside that at some former period the water had free access to the cavern. Subsequently there came a time when it entered only occasionally, supposed to be during abnormally high floods. This inference was based on the fact that intercalated with the stratified beds in its upper portion were seven layers of stalagmite. "Le limon," writes M. Dupont, "dû aux inondations du fleuve, contenait sept nappes successives de stalagmite, indiquant autant d'émersions de la caverne, de même que les sept nappes alternantes de vase indiquaient sept inondations." [3]

1 Le Préhistorique, p. 243.
2 L'Homme pendant les Âges de la Pierre, 1872, p. 96.
3 *Loc. cit.*, p. 97.

Bones were found immediately above the first, second, and seventh of these stalagmitic floors; and it was over the second, counting from below, or below the fifth, counting from above, at a depth of about 4·50m. from the surface of the final floor of the cave, that the jaw in question was discovered. Scattered through the same horizontal stratum were found three other human bones which might have belonged to the same skeleton—viz., a canine tooth, an ulna, and one of the metatarsal bones; also a large number of bones representing the following animals[1]:—

Mammoth	1	Field-mouse	1
Rhinoceros	3	Water-rat	1
Horse	2	Hare	5
Wild boar	3	Brown bear	3
Small ox	1	Polecat	1
Goat	5	Wolf	3
Chamois	2	Fox	4
Reindeer	3	Dog	2
Stag	2	Wild cat	2
Kid	1	Wild duck	1
Marmotte	1	Crow	1
Squirrel	1	Thrush	2

Batrachians and fresh-water fish.

M. Dupont states that there can be no doubt that most of these animals formed the food of man in the cave, as their remains consisted mostly of broken skulls and limb bones—the latter being split longitudinally for the purpose of extracting the marrow. Some of the bones actually showed the marks of the blows by which they had been broken, and one piece had an artificial perforation.

[1] The figures after the names indicate the number of individuals identified.

But it is the human jaw (Figs. 48 and 49) which gives to this find its special importance. Though, unfor-

Fig. 48.—*Naulette jaw—side view* (½). (M. Dupont.)

tunately, only a fragment, it presents certain peculiarities which in a very marked degree differentiate it

Fig. 49.—*Naulette jaw—view from above* (½). (M. Dupont.)

from the corresponding bone in modern races. These may be stated as follows:—

1. Its small height in proportion to the thickness of the body gives it an exceptionally stumpy appearance.
2. The chin, instead of projecting forward, slopes

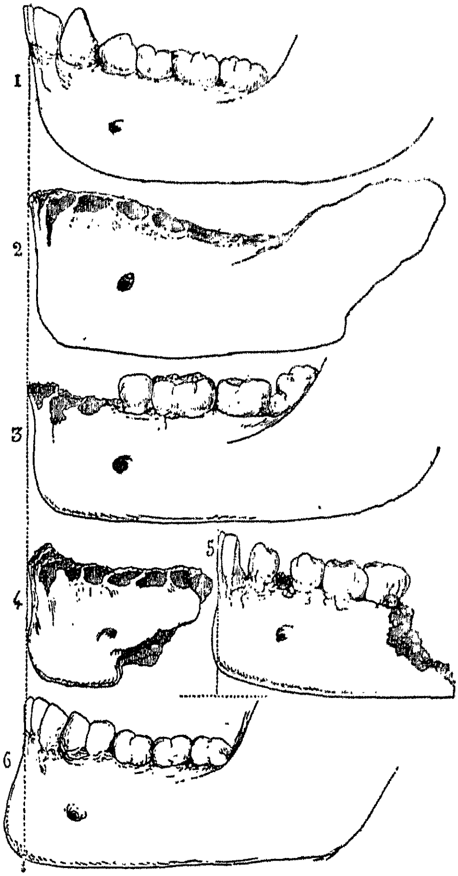
backwards; and the "genial tubercles" on its inner surface are entirely awanting.

3. The posterior molar, or wisdom tooth, is larger than the two molars anterior to it (as shown by the size of their respective sockets, all the teeth being absent from the specimen), a fact said to be the reverse of what is to be found in modern races. Further, the socket of the former shows the impressions of five roots—a peculiarity which, according to Dr Hamy,[1] is very rarely observed in man, except among the lowest races of the present day. Also the extremities of the alveolar arch come closer to each other than in the ordinary human jaw, a feature which gives the entire curve the appearance of a horse-shoe.

Specialists in comparative anatomy regard all these peculiarities as simian characteristics. Dr Broca informs us that, though they have all been observed more or less in other human jaws, they have never before been known to be all conjoined in the same specimen. Hence he concludes that the Naulette jaw, in its anatomical characters, approaches the simian type more than any hitherto known. "Nous serons autorisés à conclure," says he, "que cette mâchoire, dont l'antiquité prodigieuse remonte au temps du mammouth, est de tous les restes humains que l'on connaît jusqu'ici, celui qui se rapproche le plus du type des singes."[2] With respect to the retreating slope of the chin, and the character of the teeth, he considers that the individual

[1] Précis de Paléontologie humaine, p. 234.
[2] Congrès Inter. d'Anth. et d'Arch. préhistoriques, Paris, 1867, p. 401.

who owned the Naulette jaw held an intermediate place between man and the anthropoid apes; and, in support of this view, he gives an outline sketch (Fig. 50) of



1. Chimpanzee—*Troglodytes Aubryi.*

2. The Naulette jaw, from the valley of the Lesse, Belgium.

3. Melanesian, from the New Hebrides.

4. The Arcy jaw, from the *Grotte des Fées* (Yonne).

5. From the dolmen of Chamans (Oise).

6. Modern Parisian.

Fig. 50.—*Profile of various lower jaws, showing degrees of prognathism.* (After Broca.)

a number of human jaws, showing a regular upward gradation from the chimpanzee to a modern Parisian.

The Arcy jaw, figured in this illustration (No. 4),

was found in the *Grotte des Fées*, at Arcy-sur-Cure (Yonne), explored in 1859 by the Marquis de Vibraye. It was dug out of a lower stratum in association with the remains of cave-bear, hyena, mammoth, and rhinoceros.[1]

Another fragment of a lower jaw, found in the cave of Schipka, in Moravia, and described by Herr Maschka as a quaternary relic, has given rise to a lengthened controversy among German anthropologists—Professors Schaaffhausen and Virchow figuring as the chief disputants. The former expressed the opinion that the bone was that of a child of an extremely pithecoid appearance. This statement Professor Virchow categorically denied, and gave reasons at great length to show that it belonged to an adult, and had no pithecoid character at all. But the relic is too fragmentary and the history of its discovery too equivocal to be profitably discussed here.[2]

Anthropological Importance of Skulls.

Notwithstanding the significance of human jaws and teeth as elements of racial distinction, it is to a series of skulls that we must look for a graduated record, if such is to be found, of the intellectual changes through which Man has passed since he parted company with the lower animals. It is, however, hopeless to find any fossil remains to which a negative objection may not be offered, owing to some defec-

[1] Bull. Soc. Geolog. de France, 2d series, vol. xvii., 1860.

[2] See 'Zeit. für Ethnologie,' 1882: 'Verhand. der Berliner Gesell. für Anth.,' 1886; and 'Mitt. der Anth. Gesell. in Wien,' 1882.

tive link in the chain of reasoning. Indeed, in this kind of research, individual evidence seldom amounts to anything more than a reasonable probability; and it is only by a series of corroborative instances that the argument for the mental evolution of Man can be strengthened to the extent of carrying conviction with it. The fossil skulls already put on record are so numerous that to examine them all, with the view of sifting their anthropological value, would require a special treatise. I shall therefore confine my present notes to a few of the more important, and especially to the more recent discoveries. To those who seek results with as little labour as possible, this curtailment will be an advantage; whilst to those who may wish for fuller information the path will be lightened by the references here given. Moreover, the earlier discussions on the subject are more or less treated of in a number of popular and easily accessible works, such as those of Lyell, Huxley, Lubbock, Boyd-Dawkins, Hamy, De Quatrefages, De Mortillet, &c.

Neanderthal Skull.

In 1857 Professor Schaaffhausen and Dr Fuhlrott[1] published an account of a skeleton found in the cave of Feldhofen, situated at the entrance to a small ravine called Neanderthal, on the right bank of the river Düssel. The opening to the cave was from a small terrace in a steep limestone cliff, about 60 feet above the bed of the river and 110 feet below the surface of the plateau above. The cave has long ago been

[1] Translated in 'Natural History Review' for 1861.

quarried away, but its dimensions are reported to have been about 16 feet in length, 11 feet in breadth, and 8 feet in height. Lyell gives a section showing a natural rent connecting the cave with the surface of the plateau above. The very existence of this rent, at any time, is categorically denied by M. de Mortillet. "Dans un dessin," says he, "qui court tous les ouvrages de paléoethnologie, Lyell représente un couloir qui, partant du fond de la grotte, remonte en s'arquant jusqu'à la surface du plateau. C'est une pure conception théorique. Ce couloir n'a jamais été constaté."[1]

On the uneven floor of the cave lay a mass of consolidated mud, about 5 feet in depth, without stalagmitic deposits, but sparingly mixed with rounded fragments of chert.

In the removing of this deposit [writes Dr Fuhlrott as translated by Mr Busk] the bones were discovered. The skull was first noticed, placed nearest to the entrance of the cavern; and, further in, the other bones, lying in the same horizontal plane. Of this I was assured in the most positive terms by two labourers who were employed to clear out the grotto, and who were questioned by me on the spot. At first no idea was entertained of the bones being human; and it was not till several weeks after their discovery that they were recognised as such by me, and placed in security. But, as the importance of the discovery was not at the time perceived, the labourers were very careless in the collecting, and secured chiefly only the larger bones; and to this circumstance it may be attributed that fragments merely of the probably perfect skeleton came into my possession.[2]

The discovery was made in August 1856, and Dr Fuhlrott arrived on the scene only in time to save

[1] Le Préhistorique, p. 232.
[2] Natural History Review, 1861, p. 156.

and secure the skull-cap, the two thigh- and arm-bones, portions of the forearms, a fragment of the right shoulder-blade, the left ilium, and five fragments of ribs.

No other animal remains, with the exception of a bear's tooth, of which neither the position nor character was determined, were discovered in the cave. Professor Schaaffhausen describes the cranium as covered, both on its outer and inner surface, with a profusion of minute dendritical crystallisations; from which, however, no chronological inference can be drawn, as, according to v. Meyer, such deposits are no proof of vast antiquity, he himself being in possession of a dog's skull from a neighbouring Roman camp (*Castrum Hadrianum*) with similar marks. It may also be mentioned that the country above the Neanderthal is overspread with *löss* or *lehm* identical with that in the Feldhofen cave; and that, some years later (1865), another cave was discovered, only 130 paces distant from the former and on the same side of the ravine, which contained not only mud of the same kind, but also bones of the rhinoceros, cave-bear, and hyena. Some of these bones, especially those of the cave-bear, are, according to Schaaffhausen, very similar in colour, density, microscopical structure, and state of preservation to the Neanderthal skeleton; and the suggestion is that the animal and human remains from both caves were contemporary.[1]

The human remains from Neanderthal, especially the skull, presented such remarkable peculiarities that,

[1] Journal de Cologne, 1st April 1866: quoted by M. de Mortillet in 'Le Préhistorique,' p. 233.

when first exhibited at a scientific meeting at Bonn, doubts were expressed by several naturalists as to whether they were really human. The limb-bones were characterised by great thickness with unusual development of the elevations and depressions for the attachment of muscles, and the ribs had a singularly rounded shape and abrupt curvature—all characters indicating great muscular power. The left humerus was more slender than the right—a fact which suggested the idea that the two did not belong to the same individual; but this was shown to have been the result of an injury during lifetime. The cranium (Figs. 51, 52, and 53) was of great size and thickness, and had a long-elliptical form, a low retreating forehead, excessive development of the frontal sinuses, and a great projection of the occipital region. The sutures were nearly obliterated, and the line of the frontal suture was marked by a slight ridge. The dimensions of the skull were as follows:—

			mm.
Antero-posterior diameter		(max.)	200
Transverse	"	"	144
Frontal	"	(min.)	106
"	"	(max.)	122
Horizontal circumference			590 (571?)
Cephalic index			72

Professor Schaaffhausen estimated its capacity at 1033·4$^{cc.}$ (63 cubic inches), and Huxley at 1330$^{cc.}$ (75 cubic inches).

In regard to this skull Professor Huxley, writing in 1863, says:—

There can be no doubt that, as Professor Schaaffhausen and Mr Busk have stated, this skull is the most brutal of all known

human skulls, resembling those of the apes not only in the prodigious development of the superciliary prominences and the forward extension of the orbits, but still more in the depressed

Fig. 51.—
Side view.

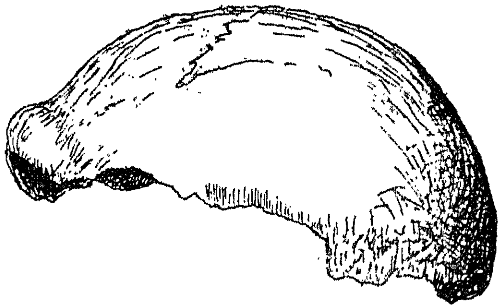


Fig. 52.—
Front view.

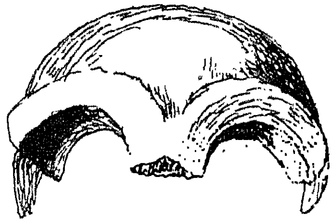
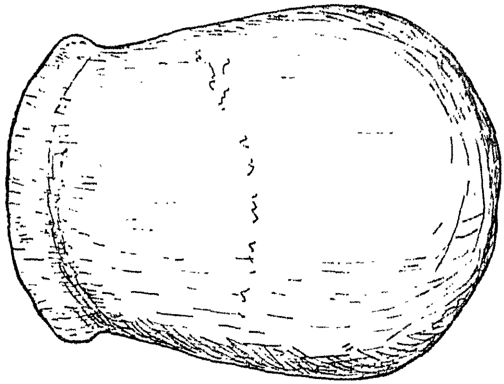


Fig. 53.—
Top view.



THE NEANDERTHAL SKULL (⅓).

form of the brain-case, in the straightness of the squamosal suture, and in the complete retreat of the occiput forward and upward, from the superior occipital ridges.[1]

[1] Lyell's Antiquity of Man, p. 84.

The Engis Skull.

The Neanderthal skull has a striking likeness in

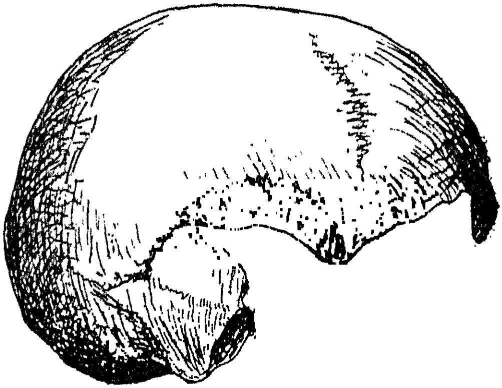


Fig. 54.—
Side view.

Fig. 55.—
Front view.

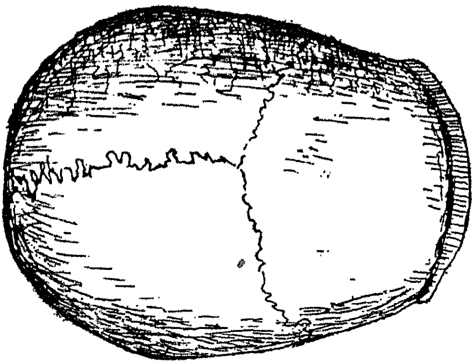


Fig. 56.—
Top view.

THE SKULL OF ENGIS (⅓).

every respect to that found at Canstadt,—so much so, that the race is called sometimes after the one

and sometimes after the other. The famous Engis skull (Figs. 54, 55, and 56), although equally dolichocephalic, has not such a brutal appearance, and all its prominences and features are more like those of modern skulls. Indeed, considering all the circumstances, it appears to me that an exaggerated importance has been given to this specimen on account of its supposed great antiquity, which, it was thought, had been established beyond doubt by the presence in the same matrix of bones of the extinct quadrupeds, forgetting that along with the remains of the mammoth, rhinoceros, cave-bear, and hyena, there were also those of the brown bear, stag, wolf, fox, beaver, and other animals still living. M. de Mortillet suggests that the six or seven human skeletons found in the Liége group of caverns—of which Engis was one—were neither more nor less than neolithic interments.[1]

The Olmo Skull.

In 1863 a human skull, a flint implement, the lower jaw of a horse, and a portion of the tusk of an elephant were found in a railway cutting at a place called Olmo, in the valley of the Arno, above Florence. All these relics are described as lying on the same level within a few yards of each other, and at a depth of about 15$^{m.}$ (49 feet) from the surface. MM. de Quatrefages and Hamy have accepted this skull as an example of the Canstadt type; but geologists are not agreed as to the chronology of the deposit, some regarding it as

[1] Le Préhistorique, p. 342.

Pliocene, while M. de Mortillet, judging from the workmanship of the flint implement, holds it to be quaternary (Moustérien).[1]

The Eguisheim Skull.

In 1867 M. Faudel[2] reported the discovery of fragments of a human skull of the same type (Canstadt) at a depth of about 8 feet in *lehm*, at Eguisheim, near Colmar, associated with a mammoth-tooth, the forehead of a great stag, the metacarpal bone of a small horse, &c. The skull is said to have a similar appearance to that from Neanderthal, especially in the projection of the occipital region, but the superciliary ridges and frontal sinuses were less prominent. It was, however, too fragmentary to supply more than suggestive results.

A Human Skeleton at Clichy.

In 1868 M. E. Bertrand announced the discovery of a human skeleton in the gravel-pits of Clichy, near Paris, along with some animal bones — elephant, ox, horse, and stag — which MM. de Quatrefages and Hamy assign to the Canstadt type. On the other hand, M. de Mortillet, for reasons which seem to me plausible, does not accept these remains as belonging to the Quaternary period at all. It would appear that the bones were all huddled together in one confined space and picked up during the absence of the

[1] Mem. della Societa de Sc. Nat. Milan, 1867.
[2] Bull. Soc. Hist. Nat. de Colmar.

workmen. M. de Mortillet asserts that they were a hoard of the workmen, who were in the habit of collecting relics and temporarily concealing them, so as to be at hand for sale to collectors who happened to visit the pits. Although this doubt vitiates the argumentative value of the skull, it does not necessarily follow that it was not found in the gravels.[1]

The Skeleton of Brux.

In 1872 the skull and other bones of a human skeleton of Canstadt type were discovered at Brux, in Bohemia, buried in what is described as a bed of quaternary sand. The sand attained a thickness of 6 feet, and above it was a layer of ordinary soil to a depth of 2 feet. The skeleton lay 4 feet 8 inches from the surface of the soil. Its contemporaneity with this quaternary sand is, however, questioned on the ground that near the same place, at a depth of 6¼ inches in the sand, a perforated stone hammer of undoubted neolithic type had also been disinterred. Those who regard the Brux skeleton as Palæolithic account for the presence of the stone hammer by supposing that it had got so far buried in consequence of the usual disturbances of the cultivated soil.[2]

"Les Hommes de Spy."

Among the fossil remains of Man hitherto found in Europe those known as "les hommes de Spy" appear

[1] Bull. Soc. Anth. de Paris, 1883.
[2] Mitt. der. Anth. Gesell. in Wien, 1872.

to be most important. In 1886 two skeletons were found deeply buried in undisturbed *débris* at the entrance to a grotto called Belche-aux-Roches, at Spy-sur-l'Orneau, in the province of Namur, Belgium. The interior of the grotto had been examined more than once, but in front of it there was a terrace, projecting 13 yards, which had not been previously excavated. It was in this terrace that MM. Lohest and De Puydt made excavations which unearthed the

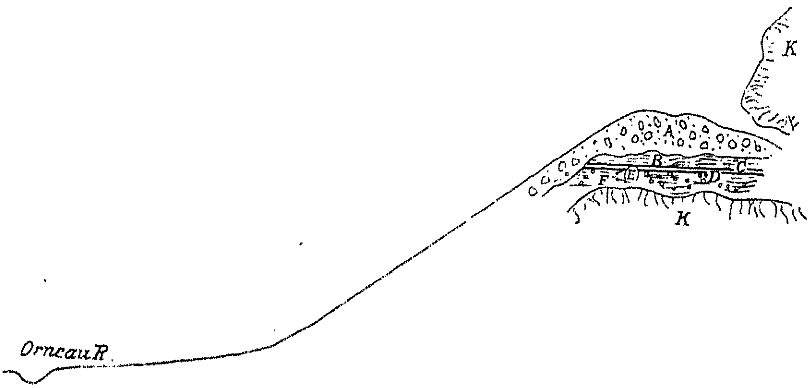


Fig. 57.—*Section of the Grotto of Spy.*

skeletons. The outer skeleton was found at a distance of 26 feet from the entrance to the cave, and under a mass of rubbish 12 feet 6 inches in depth, composed of four distinct strata, none of which appeared to have been hitherto broken through. It lay on the right side, across the axis of the cave, with the hand resting on the lower jaw, and the head towards the east. The other skeleton was 8 feet nearer the present entrance to the cave, but its position was not determined with so much accuracy as the first named.

Associated with these skeletons—*i.e.*, on the same stratum—were worked flints of the type known as

Fig. 58.—
Side view.

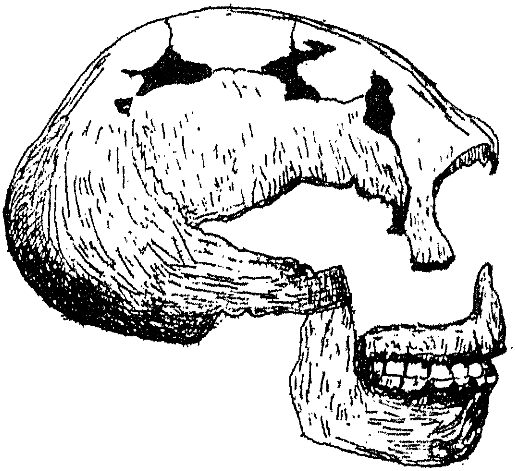
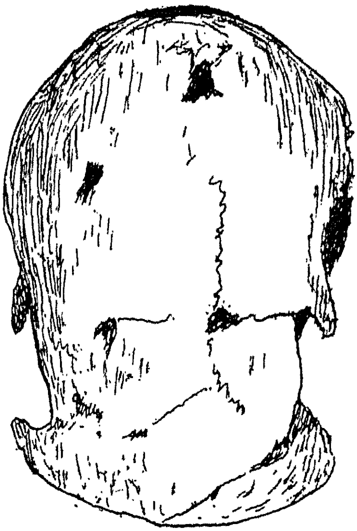


Fig. 59.—
Top view.



SKULL FROM THE GROTTO OF SPY (⅓). (After Prof. Fraipont.)

Moustérien, and some animal remains representing the following fauna:—

Rhinoceros tichorhinus (abondant).
Equus caballus (très abondant).
Cervus elaphus (rare).
Cervus tarandus (très rare).
Bos primigenius (assez abondant).
Elephas primigenius (abondant).
Ursus spelæus (rare).
Meles taxus (rare).
Hyena spelæa (abondante).[1]

Immediately above the skeletons was a hardened layer composed of chippings of ivory and flint, pieces of charcoal, and some angular stones of the surrounding limestone rock. Above this there was a reddish deposit containing the remains of the same fauna, but the worked objects indicated a decided advance in civilisation—awls and borers of flint; needles, beads, and ornaments of bone and ivory. Over this came a bed of yellowish clay, in which were still found bones of the mammoth as well as flint implements. And, finally, there was a mass of clay and fallen rocks, without relics of any kind (see section, Fig. 57).

The possibility of these bodies being brought here and buried in graves dug for the purpose is, according to MM. Fraipont and Lohest, inadmissible. This is how they account for them. "L'interprétation le plus logique, au contraire, qu'il soit permis de donner à la coupe constatée, est que les hommes de Spy sont morts à l'entrée de la grotte qui leur avait servi de demeure, sur le sol qu'ils avaient en partie contribué à former par leurs débris de cuisine."[2]

The osteological characters of one of the Spy crania

[1] Congrès International, &c., Paris, 1889, p. 322.
[2] Archives de Biologie de Gand, 1886, p. 668.

correspond in a remarkable degree with those of the Neanderthal skull so frequently discussed by anthropologists (Figs. 51, 52, 53). Here are tabulated a few of Professor Fraipont's measurements[1] :—

	Spy. mm.	Neanderthal. mm.
Antero-posterior diameter (max.)	200	200
Transverse " "	140	144
Frontal (min.)	104	106
" (max.)	114	122
Horizontal circumference	580	590 (571 ?)
Cephalic index	70	72

As regards the great development of the superciliary prominences, the low retreating forehead, the depressed and elongated form of the cranium, both these skulls present a more brutal appearance than any human skull known up to the time of the Java discovery. The fragmentary condition of the Neanderthal skull prevents us carrying the comparison between these two early specimens of humanity further. The Spy skull was associated with nearly the whole skeleton, and, according to Professor Fraipont, its entire anatomical characters bear out the same lowness of type. The jaws are deep and powerful, the chin slopes away from the teeth downwards and backwards, and the teeth and alveolar border have a striking prognathic appearance. The last molar teeth do not sensibly differ from those immediately in front of them. The long bones are materially different from those of the normal Belgians of the present day, being generally shorter and stouter. The bones of the thigh and fore-

[1] Congrès International, &c., 1889, p. 333.

arm have a curiously bent appearance, and the lower ends of the former are so fashioned as to prevent the limb being fully straightened. It is, however, only just to say that, so far as the measurements of the other Spy skull could be determined, its pithecoid characters are less pronounced. The cranial vault is more lofty, and the cephalic index at least 74.

The Belgian professor came to the conclusion that the Spy men belonged to a race relatively of small stature, analogous to the modern Laplanders, having voluminous heads, massive bodies, short arms, and bent legs. They led a sedentary life, frequented caves, manufactured flint implements after the type known as Moustérien, and were contemporary with the mammoth and tichorrhine rhinoceros. From a peculiarly large and slanting appearance of the articular surfaces of the femur and tibia, he drew the inference that they could not stand perfectly erect. But at the International Congress held at Paris in 1889 Professor Manouvrier exposed the fallacy of this argument.[1]

The Galley Hill Skeleton.

A human skull and limb-bones found in the Palæolithic Terrace-gravel at Galley Hill, Kent, have been described by Mr E. T. Newton, F.R.S., F.G.S., in the 'Quarterly Journal of the Geological Society' for August 1895. According to this report the bones now in question were unearthed as far back as September 1888

[1] Cong. Internat. d'Anth. et d'Archéologie préhistorique, 1889, p. 353.

under the following circumstances, as narrated by parties who had seen them *in situ*:—

1. *Extract from a Letter to Mr Newton by Mr Robert Elliot, Camberwell, dated July* 1894.

It was my custom to visit the pits at Milton Street, Swanscombe, Galley Hill, and neighbouring excavations, every fortnight regularly (in search of flint implements) for more than two years before the discovery of the human remains, so that I was well acquainted with the pit beforehand.

In 1888 the chalk-pit itself was considerably smaller than now, and was constantly worked for chalk, used in the Cement Works, the gravels on the top being removed and "screened" on the spot. Thus the removal of the gravel had to keep pace with the excavations of the chalk beneath, so that several tons were removed daily and carted away.

It was on one of my fortnightly visits that I was informed by a man, named Jack Allsop (who had for a long time looked out and saved for me any implements or stones of similar shape, obtained while screening the ballast), that he had found a skull under the gravel. This I could hardly credit at first; but on my asking him to show it to me, he produced it in several pieces from the base of a pillar of laminated clay and sand, where he had hidden it. I asked where the rest of the bones were; he pointed to the section opposite this pillar, and a few feet from it, and told me that he had left the other bones undisturbed, for me to see; and there, sure enough, about 2 feet from the top of the chalk, and 8 feet from the top of the gravel, portions of bone were projecting from a matrix of clayey loam and sand. He also told me that several of the men employed at the works, the master of the neighbouring school, and others, had seen the skull.

The section of gravel was 10 or 11 feet thick, and extended for a considerable distance along the south and east end of the pit—several pot-holes or pipes running from it deep into the chalk.

I carefully examined the section on either side of the remains, for some distance, drawing the attention of my son Richard,

who was with me, and of Jack Allsop, to it. It presented an unbroken face of gravel stratified horizontally in bands of sand, small shingle, gravel, and, lower down, beds of clay and clayey loam, with occasional stones in it—and it was in and below this that the remains were found. We carefully looked for any signs of the section being disturbed, but failed—the stratification being unbroken, and much the same as the section in the angle of the pit remaining to this day, but it was then clear and not covered by rubbish as it now is in places, all the "callow" and loam at the top being at that time removed to allow of the gravel being got at.

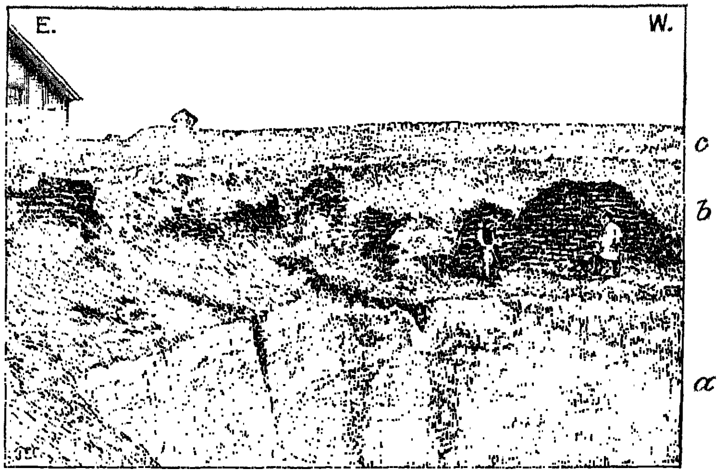
2. *Extract from a letter to Mr Newton by Mr Matthew H. Heys, Greenhithe, who was master of the neighbouring school above referred to, dated February* 1895.

In reply to your inquiries concerning the skull found in this immediate neighbourhood, I have to say that my attention was called to the spot by the workman who unearthed it, and before it was removed from its long resting-place. For the moment I was tempted to appropriate it there and then, but when I examined it more carefully I was struck by the undisturbed condition of the gravel in which it was embedded: it seemed as though gravel and skull were deposited at the same time.

Since 1888 the gravel-beds in which the bones were found have been entirely removed, and the face of the pit, at the time of Mr Newton's description, is stated to have been 10 feet removed from the exact spot in which the bones were embedded (Fig. 60); so that there is no possibility of verifying the above statements by any further inspection of the locality. It may, however, be of some interest to note that they stood some 90 feet above the Thames, and that the contiguous gravels have frequently yielded specimens of flint implements of the usual palæolithic types (Fig. 61).

The above evidence, the *bona fides* of which cannot be questioned, goes strongly to support the view that

this skeleton was contemporary with the deposition of the gravel; in which case there can be no doubt that we have in it the remains of a genuine specimen of the Palæolithic men who inhabited the South of England, and manufactured flint implements and weapons when these old rivers stood at their high-level marks. On the other hand, the theory that it was a subsequent interment has, in the hands of an objector, a certain *locus standi* which cannot be contradicted by any direct



a=Chalk; *b*=gravel; *c*=wall, behind which is the highroad. The figure on the right is represented as standing on the spot where the human remains were found.

Fig. 60.—*Chalk and Gravel Pit, Galley Hill.*

(From photograph by Mr Clement Reid and Mr J. W. Reed.)

evidence, since the column of earth above the skeleton had been removed before either of the above-named witnesses came upon the scene. The following remarks by Sir John Evans, made in the course of the discussion on Mr Newton's paper, cover, I think, all that need be said on this point:—

Sir John Evans expressed his high appreciation of the great care and wealth of detail that Mr Newton's paper exhibited. It seemed to him that the communication might be divided

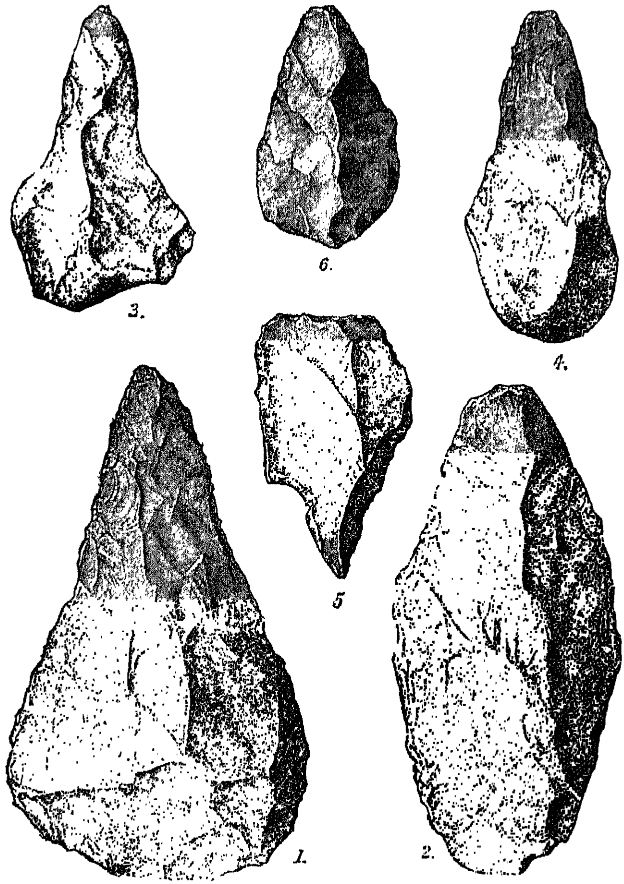


Fig. 61.—*Palæolithic flint implements from the Terrace-gravel at Galley Hill* (½).

into two absolutely distinct sections—the one anthropological, the other geological. It was on the latter branch of the subject only that he proposed to say a few words. There could be, he thought, no doubt of the deposits at and near Swanscombe being

true Pleistocene high-level gravels of the valley of the Thames; and the abundance of Palæolithic implements that occurred in them seemed to place their age beyond all doubt. With regard to the human remains, the real question at issue was whether they were deposited where found with the other constituent parts of the gravel, or not. It was unfortunate that so long a period had elapsed between the discovery of the bones and the attention of geologists being called to it. The evidence, however, of the undisturbed character of the beds seemed fairly strong, though, so far as he had understood the paper, one witness described the bones as having been found in gravel and the other in loam. Perhaps, however, both might mean the same deposit. The fact that the remains were found, not at the base of the gravels, like other bones from the same locality, but some few feet above the chalk, was noteworthy; but what weighed most with him, and led him to doubt whether the bones were of the same age as the gravels, was the fact that nearly the whole skeleton, including the lower jaw and clavicle, had been preserved. Although occasionally in brick-earth the bones of a limb might have been found together, it might be regarded as almost if not quite universally the case that in gravels isolated bones only were found. The occurrence of a nearly perfect skeleton was suggestive of an interment; and the accumulation of surface-soil above the gravel might give the grave in which the body was deposited an appearance of having been of greater depth than it actually was. On the whole, he ventured to maintain an attitude of doubt, and would await further evidence before absolutely accepting these human remains, however ancient, as being of necessity contemporaneous with the beds in which they were found.

The general features presented by the portions of the skeleton which came into Mr Newton's hands are thus described:—

All the bones are much decayed and denuded, while their outer surfaces are marked all over by vermiform depressions, such as are generally thought to be the result of close contact with the rootlets of growing plants. When first exhumed the

bones were exceedingly soft and fragile, and in spite of the care with which they were handled, were all much broken in the process of extraction from the matrix: it was necessary, therefore, to treat them with gelatine and allow them to dry and harden before they could be joined together and rendered fit for study. The presence of the last true molar, or wisdom tooth, with the crown somewhat worn, shows that the skeleton belonged to a fully grown adult, though probably not an aged individual.

From these remarks it is manifest that the human remains in question are of great antiquity, and although their contemporaneity with the natural deposition of the gravels in which they were found remains *sub judice*, they are not for this reason to be tossed aside as having no anthropological value. If it can be shown that their anatomical characters are not actually inconsistent with those of Palæolithic man, so far as they are known to us, we really establish a *prima facie* argument in favour of the opinion that the individual represented also belonged to that ancient race. Bearing in mind the views advanced elsewhere (Chap. ii.), in regard to the organic changes incidental to the erect posture, it will only be necessary here to review the special features of the cranium and lower jaw. In Mr Newton's carefully prepared description of this discovery there is not the slightest suspicion of special pleading, so that we may unreservedly accept his measurements of the skull as the most accurate that could be procured under the circumstances. Here are his words:—

The calvarium was fortunately less broken than the long bones: it is evident, however, that in drying it has become

twisted somewhat; but its general characters are clearly shown. The base and facial portions of the skull are wanting, as well as much of the left side; the right side, however, is more perfect, the outer part of the orbit, with the maxilla and jugal

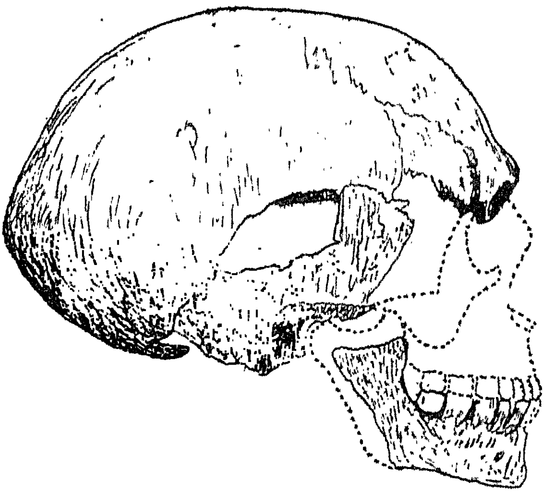


Fig. 62.—*Side view.*

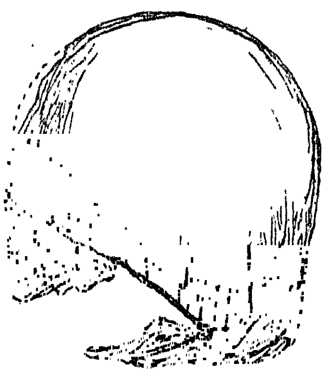


Fig. 63.—*Front view.*

THE GALLEY HILL SKULL (⅓ nat. size). (After E. T. Newton.)

bones, being all that is really absent. A portion of the foramen magnum is preserved, with sufficient of the supraoccipital bone to show the form of the under and back parts of the brain-case.

The most striking features of this skull (Figs. 62 and 63) are its extreme length (205 millim.) in proportion to its width

(about 130 millim. ?), the complete obliteration of the coronal, sagittal, and lambdoidal sutures, both internally and externally, and the prominence of the supraciliary ridges. The extreme narrowness of the cranium is best seen when viewed from above; but this peculiarity is somewhat exaggerated by the distortion which the skull has undergone, the right temporal bone, and the parts posterior to it, being pushed over towards the left side; and besides this, parts of the left side are wanting. The greatest width of the skull is low down near the mastoid region, but its imperfections prevent the exact width from being measured.

The walls of the cranium are in most parts very thick, the middle of each frontal measuring as much as 12 millim. The supraciliary ridges are very strongly developed, especially at their inner part, although now in a denuded condition: probably they were never so prominent as in the famous Neanderthal calvaria. The frontals are fairly full, and the forehead therefore only moderately receding. The highest point of the skull is in the forepart of the parietal region. The temporal ridge is not strongly marked, but extends abnormally high up on the side of the skull. The right parietal is somewhat inflated at its anterior and lower part, and this inflation is continued on to the adjoining lower part of the frontal, causing a prominent stephanic region. Towards its hinder part likewise the parietal is prominent. The occipital bone forms a well-marked boss or probole at the back of the skull, its upper part being directed well forward as well as upward; and this portion, together with the median and hinder ends of the parietals, forms a distinctly flattened area.

Its dimensions, so far as could be determined by measurements, are thus given in millimetres: circumference, 540; length, 203; breadth, 130 (?); height, 137 (?); cephalic index, 64; from which it will be seen that this skull is extremely dolichocephalic,—indeed more so than that of Neanderthal or those of Spy, as shown on p. 140.

In addition to these cranial features Dr Garson drew attention to the large size of the last molar tooth, "which was as large as, if not larger than, the first molar"; whereas in neolithic and modern times the corresponding tooth was always smaller than those in front of it. The lower jaw (only a fragment) disclosed no evidence of a pronounced prognathism, and the chin was fairly prominent.

Under these circumstances it is manifest that no important deductions can be founded on the anatomical characters of the Galley Hill skull beyond the fact that, like the other well-attested quaternary skulls, it is dolichocephalic, and shows similar peculiarities both as regards the receding forehead and the angular prominence of the occiput.

Pithecanthropus erectus.

The next and most recent remains of fossil Man, on which I wish to make a few observations, are those discovered in 1891-92 by Dr Eugène Dubois on the island of Java, consisting of a calvaria, two molar teeth, and a left femur. After carefully comparing these bones with the corresponding parts of other human skeletons, both fossil and modern, and of the anthropoid apes, Dr Dubois published, in 1894, a very complete memoir on the subject, giving descriptive details and photogravures of each bone. In this memoir he attributes the remains to an animal having an erect attitude like man, and a brain-case with mixed characters, partly simian and partly human, to which he has given the name *Pithec-*

anthropus erectus. The conclusions arrived at by Dr Dubois have already been so largely criticised in the chief anthropological Societies and Journals throughout Europe, that it is unnecessary now to do more than to re-state the main facts and arguments, in the light of some supplementary data which the author has more recently supplied in regard to the geological conditions under which the remains were found—a subject not very clearly elucidated in the original memoir. This information is contained in a paper communicated to the Royal Dublin Society on November 25, 1895,[1] from which the following is an extract:—

From Trinil to Ngawi the steep banks of the Bengawan or Solo river, for an extent of 7½ miles, consist exclusively of the above-mentioned volcanic sands and lapilli, cemented into soft rocks, very much like the rocks which I saw in the Siwalik hills. The strata have in this area a general dip S. of about 5°, and are only concealed by a thin covering of vegetable soil. In these strata the Solo river has cut its channel, 12 to 15 metres deep, near Trinil. North and west of Trinil the Pliocene marl and limestone appear under them. When I first, in August 1891, came upon the rich bone-mine of Trinil, I had already made many finds of bones at several places round about that village. All belonged to the same homogeneous fauna which I had found in other parts of the Kendeng hills. The first fossil bones were a horn of a small species of deer, which is among the commonest of the fauna, a molar tooth of Stegodon, and a few other remains belonging to the same fauna. They were dug out of the rock by means of chisel and hammer, and the excavations were performed in such a manner that the rock was carefully removed in thin layers. It consists (Fig. 64) from higher to lower of variously coloured sand-rock, which becomes coarser, whilst more and more lapilli occur in it, and

[1] Scientific Transactions, vol. vi., 2d series.

the latter prevail in the deepest bed, about one metre thick, passing downward over into a conglomerate bed. Under this follows a bed of hardened blackish clay, sharply separated, which does not contain any bones. The latter, in the sand-rock, increase in number from higher to lower, so that the lapilli bed is the richest: the conglomerate bed, however, contains but few bones.

A. Vegetable soil.
B. Sand-rock.
C. Bed of lapilli-rock.
D. Level in which the four remains were found.
E. Conglomerate.
F. Clay-rock.
G. Marine breccia.
H. Rainy season level of river.
I. Dry season level of river.

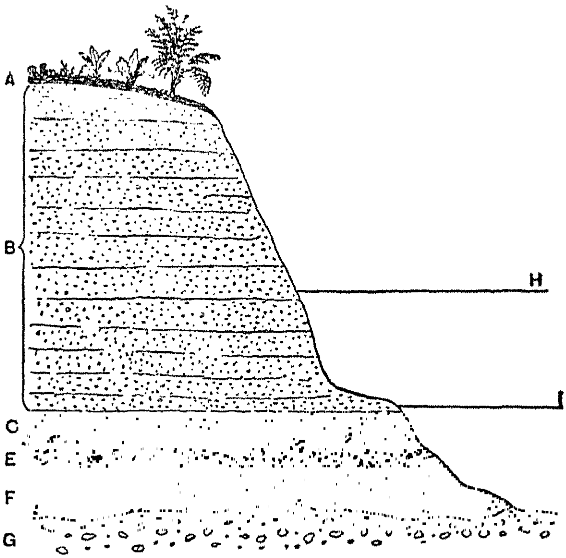


Fig. 64.—*Section of the bone strata at Trinil.* (Dr Dubois.)

Among hundreds of other skeleton remains, in the lapilli bed on the left bank of the river, the third molar tooth was first found in September; then, the hole having been enlarged, the cranium a month later, at about 1 metre distant from the former, but in the very same level of that bed. The species of mammals, of which remains were found in the same bed, are, for the greater part at least, extinct ones, and almost certainly none of them are at present living in Java. Among these remains we find a great number of the above-mentioned small species of Cervus, which certainly is not extant in the Malayan isles. Also many bones of Stegodon were found. One or two Bubalus species seem to be identical with Siwalik species; a

Boselaphus undoubtedly differs from the known species, living and fossil. Further on there were found the extinct genus Leptobos, the genera Rhinoceros, Sus, Felis, Hyena, and others; a Gavial and a Crocodile, differing little from the existing species in India, but which cannot be classed among them.

Of the animals found in the same strata in other places, the most interesting species are a gigantic Pangolin (Manis), three times as large as the existing Javanese species, and a Hippopotamus belonging to an extinct Siwalik subgenus. Further, a Tapir and an Elaphas.

The work having been brought to an end that year on account of the setting in of the rainy season, it was taken up again at the beginning of the dry season in May 1892. A new cutting was now made in the left rocky bank, which comprised the still unfinished part of the old excavation. Thereby bones were again found in great numbers, especially in the deeper beds; and among these, again in the same level of the lapilli bed which had contained the skull-cap and the molar tooth, the left femur was found in August, at a distance of about 15 metres from the former; and at last, in October, a second molar, at a distance of 3 metres at the most from the place where the skull-cap was discovered, and in the direction of the place where the femur had been dug out. This tooth I did not describe, because I only found it later among a collection of teeth derived from the place stated above.

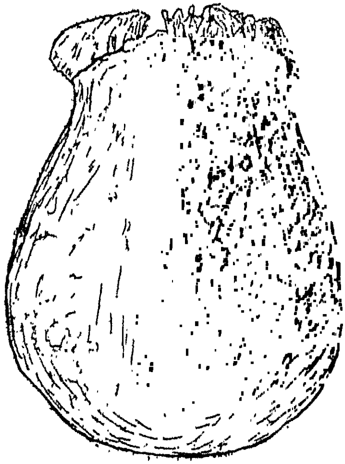
After explaining that certain irregularities observed on the surface of the skull-cap, ascribed by some to rubbing and by others to disease, were brought about in the place of deposit by acidulous water percolating through the rocks—all the other bones being more or less similarly corroded by it—the author goes on to combat the doubt whether the separate bones belonged to one and the same animal:—

A doubt whether the four remains were once organically connected is certainly comprehensible, and was pronounced

from different sides. Nevertheless, it seems to me that this doubt is hardly allowable, on account of the short distance of the places of discovery from one another,—for a distance of 15 metres is so small that, as an argument against the supposition that the bones belonged to the same skeleton, it cannot be considered as of more importance than if the bones

Fig. 65.—
Side view.

Fig. 66.—
Top view.



THE SKULL OF *Pithecanthropus erectus*, JAVA (¼). (After Dr Dubois.)

had been found in contact with one another. I often found bones from the self-same skeleton, and even fragments of one bone, at corresponding distances. I daresay that every palæontologist who has made any excavations for fossil vertebrate remains has had the same experience. I never found in one place anything like a complete skeleton, and, as certainly the bones once belonged all to complete skeletons,

the bones must have been all dispersed. I have good reason to think that the animals perished in volcanic catastrophes, and that their corpses were brought down in the current of a large Pliocene river. Before, then, the bones were definitely deposited and buried in the old alluvia, they must generally have been separated through the rotting of the flesh, and torn the one from the other, and dragged away with the adhering flesh by crocodiles. Many remains of these preying water-reptiles, and also the traces of their teeth in spongy parts of bones, were found. So this argument against the assumption that the femur ascribed by me to the Pithecanthropus belonged to the same skeleton as the skull-cap, fails.

The bones of Pithecanthropus had a chocolate-brown colour, and, in common with all others, human or not, were greatly impregnated with calcareous matter, which rendered them exceptionally hard and heavy. The weight of the femur is stated to have been double that of a recent human femur of the same dimensions.

The Cranium.—External surface (Figs. 65 and 66) generally smooth and without any marked ridges; sutures almost entirely obliterated; frontal bone slightly keel-shaped in the line of the frontal suture; glabella, supraorbital ridges, and occipital protuberance strikingly prominent; cranial vault depressed, and on section (antero-posterior) shows an arch intermediate between that of the anthropoid apes and of the average European man. Its general dimensions may be thus stated:—

Antero-posterior diameter (max.) . .	185$^{mm.}$
Transverse " "	130 "
" " (behind the orbit)	90 "
Height in the parietal region (max.) . .	62 "
Cephalic index	70 "
Estimated cranial capacity	1000^{cc}

Teeth.—As to the two molar teeth, there is so much difference of opinion among specialists—some considering them simian and others human—that it is unnecessary to add any further proof of their intermediate character. In Manouvrier's estimation the third molar has a decidedly simian character as regards the size of the fangs, but human as regards the crown surface.[1]

The Femur.—The femur has been regarded by most of the anatomists who have critically examined it as human—Professor Virchow being almost alone in maintaining that it might have belonged to an ape, probably Hylobates. Dr Dubois, however, lays stress on three minor characters, which he thinks differentiate it from the typical human femur. But these distinctions have been conclusively shown to be untenable, as they have been found on recent human femora with sufficient frequency to be ranked as human characters.[2] Its length, from the highest point of the head to a line between the lowest points of the condyles, is 455$^{mm.}$ The bone has suffered little injury, but it presents, on the inner and back part of the upper third of the shaft, an irregular exostosis due to some accidental cause during lifetime.

Such are the main facts on which Dr Dubois bases his theory that these four skeleton-bones belonged to a creature which was neither man nor ape, but a transi-

[1] Bull. Soc. d'Anth. de Paris, vol. vi., 4th series, p. 18.

[2] See Manouvrier (*loco cit.*, p. 15) and Dr Hepburn on the Trinil Femur—Abstract of paper to the British Association for the Advancement of Science, Liverpool Meeting, 1896.

tional form between the two (*eine menschenaenliche Uebergangsform*). It is not my intention to follow the author over the wide domain from which he has culled the arguments with which he supports his theory. Suffice it to say that, by an elaborate series of measurements, comparisons, and calculations, he has shown that

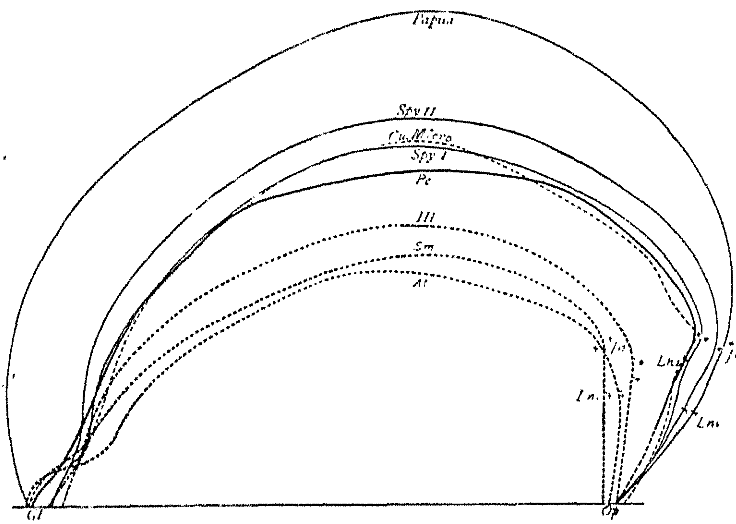


Fig. 67.—*Profile outlines of the skulls of* Pithecanthropus erectus (*Pe*), *a Papuan man, the Spy men, a microcephal* (*Cu Micro*), Hylobates leuciscus (*Hl*), Semnopithecus maurus (*Sm*), *and* Anthropopithecus troglodytes (*At*). *Gl*=*Glabella*; *Op*=*Opisthion*; *Jn*=*Linea nuchæ superior*; *Lni*=*Linea nuchæ inferior*. (Dr Dubois.)

the brain-capacity of the Java skull ranks considerably lower than that of man, but higher than that of any of the anthropoid apes. Some idea of the value of the results thus obtained may be gathered from an inspection of the accompanying diagram (Fig. 67), in which the profile outline of the skulls of a Papuan, the fossil "men of Spy," a microcephal, and a number of apes are

superimposed, so as to exhibit at a glance the expansion of their respective cranial arches.

Classification of Skulls into Dolichocephalic and Brachycephalic.

It has been already shown that the classification of fossil skulls, according to their cephalic index, which ranges from 70 up to 84, or even more, embraces the extremes of dolichocephalism and brachycephalism. The skulls selected for description come under the former category. According to M. de Quatrefages, this type (Canstadt) has continued during the whole Quaternary and Neolithic periods (and even survives to the present day), but undergoing a progressive change towards modern types.[1] This change was well marked in the anatomical characters of the Engis skull, which, as has been already observed, had a less brutal appearance than that of Neanderthal. A more decided human development is seen in the skull of the "old man of Cromagnon" (Figs. 68 and 69), which, though equally dolichocephalic, was large, lofty, and well-proportioned both anteriorly and posteriorly. Its cephalic index was 73·6 and its capacity 1590$^{cc.}$ (96·99 cubic inches). The highest antiquity that can be assigned to it is the very end of the Reindeer period in France—a period when man was so civilised that he was an adept in the art of sculpturing and carving on bone life-like representations of the animals with which he was acquainted (see p. 48). The old man of Cromagnon is thus, in all probability,

[1] Human Species, p. 307.

separated from the famous Neanderthal Troglodyte by

Fig. 68.—
Side view.

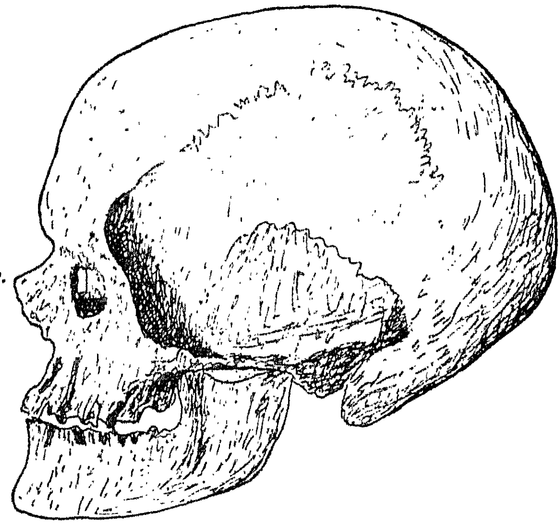
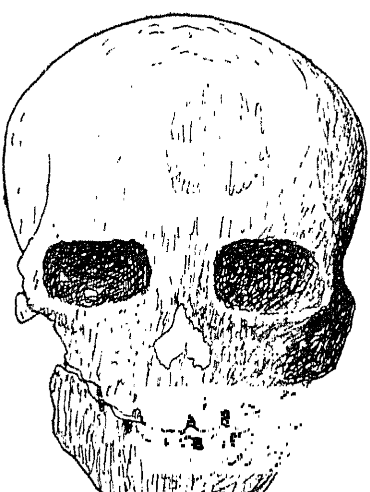


Fig. 69.—
Front view.



SKULL OF THE OLD MAN OF CROMAGNON (⅓).

an interval of time which can only be approximately

measured by the duration of the larger portion of the glacial period. The appearance of brachycephalic races in Central Europe, at the beginning of the Neolithic period, is an ethnological phenomenon which has not yet been satisfactorily explained. For it has been proved by the contents of the dolmens, and other sepulchral tombs,[1] that two distinct races lived contemporaneously with each other in the south of France. In the artificial caves of Petit-Morin (Marne), investigated by Baron de Baye,[2] the two races seemed to have more or less coalesced. The Furfooz race of MM. de Quatrefages and Hamy, as revealed by the sepulchral remains in the Trou du Frontal, is now regarded by those most competent to judge as neolithic.

From the amalgamation of these varied races the highly mixed populations of modern Europe can be readily accounted for; but whether the brachycephalic people have been evolved from the older dolichocephalic types still remains a controverted problem. To my mind the glimpses which both archæology and human palæontology have given us of the career of man in Europe agree in support of the hypothesis that two peoples long and widely separated had come into contact in Southern France, and perhaps elsewhere, at the close of the Reindeer period. Of these the dolichocephalic were the oldest, and probably the direct representatives of Palæolithic man.

But the whole subject is full of pitfalls, even to the most wary. Of the difficulties one meets with in at-

[1] Revue d'Anthropologie, 1873; Matériaux, vol. xii., 1877, &c.
[2] L'Archéologie Préhistorique.

tempting to define the chronological horizon of the specimens of "fossil man," which now and again come to light, we have an excellent illustration in the circumstances connected with the human skeleton found a few years ago at Brünn, in Moravia. Here, in September 1891, in the course of digging a canal, the workmen came upon an osseous deposit, at a depth of over $4^{m.}$, in the *löss* which underlies the town, containing bones and teeth of the rhinoceros and mammoth, some smaller bones of a brick-red colour, and a few worked discs of stone and bone. As the line of the canal cut through the osseous deposit, a special excavation was necessary to determine its nature and contents. This was successfully carried out, a couple of months later, by Mr Alex. Makowsky. A pit, ultimately covering an area of 8 square metres, was dug at the place indicated near the canal basin, and at a depth of $4{\cdot}50^{m.}$ they encountered a layer of *löss* of a reddish colour. Up to this point nothing had been observed to indicate that the superjacent deposits had been previously disturbed. In this reddish deposit they found a mammoth's tusk, one metre in length and about the thickness of a man's arm; but it was so friable, owing to decay, that it could only be abstracted in fragments. Immediately underneath the tusk lay an almost entire shoulder-blade of a mammoth, and close to it the skull and some of the upper trunk-bones of a human skeleton. It was only then ascertained that the rest of the human skeleton had been removed some weeks earlier, when the canal was being excavated. Incidentally a workman trampled on the skeleton, and so damaged the jaw-bones and the anterior

portion of the right side of the skull. Within the radius of a metre from the human skeleton there were found the skull and some ribs of a rhinoceros, a few teeth of the horse, and the following relics of man's handiwork :—

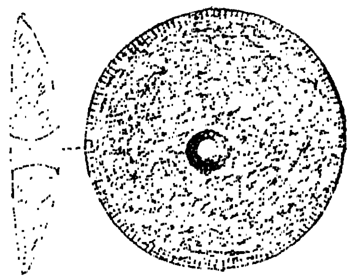


Fig. 70.—*Disc made of a mammoth tusk* (2/3).

1. Over 600 fragments of fossil tooth-shells (*Dentalium badense*), originally emanating from tertiary deposits some 10 or 15 kilometres south of Brünn, which were supposed to have been used as a necklet or some kind of head-ornament.

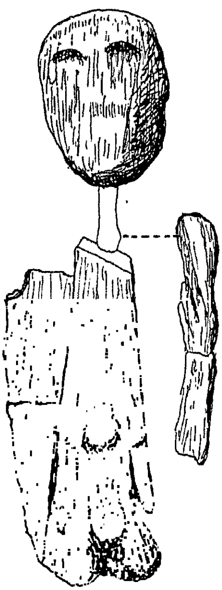


Fig. 71.—*An "Idol" made of a portion of a mammoth tusk* (1/3).

2. Two discs of limestone ($14^{cm.}$ and $15^{cm.}$ in diameter) perforated in the centre by a large circular hole. Also sixteen smaller discs (from $3{\cdot}5^{cm.}$ to $6^{cm.}$ in diameter), five made of stone, three of bone (ribs of rhinoceros), and eight of ivory. Some of these discs were perforated in the centre; and others were ornamented with marginal notches and grooves running from the centre to the circumference (Fig. 70).

3. A fragment of a polished implement made of a reindeer-horn having one end rounded, and the tooth of a rhinoceros showing artificial markings on its surface.

4. The broken figure of a nude man sculptured in ivory, said to be an "idol." What remained of it was in three portions, as shown on Fig. 71—the right arm, left hand, and the lower limbs being awanting. The trunk was perforated lengthways by a small hole, the lower orifice of which measured $4^{mm.}$ and the upper $1^{mm.}$

The reddish colour of the *löss*, in which these relics were found, was due to a layer of red ochre (oxide of iron with some carbonate of lime and silica) which had been spread over the human skeleton.

The skull (Fig. 72) was extremely dolichocephalic and

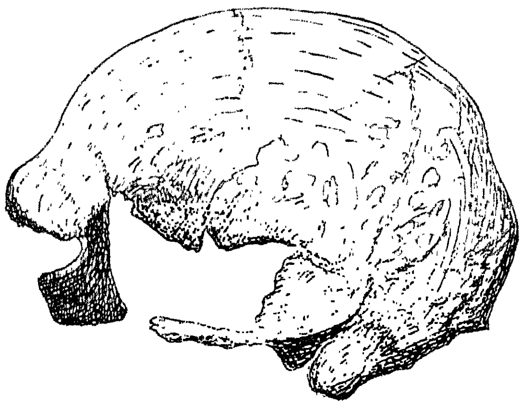


Fig. 72.—*Side view of the skull of Brünn* (⅓).

otherwise remarkable; but the former character might have been somewhat magnified by the injury it had sustained from the man treading on it. Towards the frontal and occipital regions it presented the characters of the Canstadt type, while its middle or temporal parts resembled the Cromagnon skull. Its estimated capacity, according to Professor Schaaffhausen, was $1350^{c.cm.}$ It is also said to have a strong similarity to another skull

which was found in the *löss* in 1885, at a depth of 6m., as shown in the following measurements:—

	Cromagnon skull. mm.	1891 skull. mm.	1885 skull. mm.
Antero-posterior diameter .	202	204	192
Frontal transverse (max.) .	149	134	139
" " (min.) .	103	95	90
Horizontal circumference .	568	533	520
Cephalic index . . .	74	65·7	72.3

Both Mr Makowsky[1] and Professor Schaaffhausen,[2] to whose reports we owe these details, have come to the conclusion that the owner of the Brünn skeleton was contemporary with the mammoth. But the value of this opinion is somewhat obscured by their contention that the mammoth might have survived longer here than elsewhere in Europe. Judging from the class of associated relics, their style of ornamentation, and the application of red colouring matter to the body, I agree with M. G. Hervé[3] in regarding the Brünn skeleton as belonging to the proto-neolithic race of Engis, Cromagnon, Mentone, l'Homme-Mort, &c.

This closes my notes on "Fossil Man," not, however, because the materials are exhausted, but because the examples given are among the oldest and most significant which have hitherto come to light. The human remains discovered at Cromagnon, Laugerie-Basse, Raymond, and other rock-shelters in the Dordogne district, la Grotte d'Aurignac, le Trou du Frontal, the Balzi Rossi caves, as well as many stations of the Reindeer period in Southern France, belong, in my opinion, to the very end of the quaternary, or even to a still later, period.

[1] Mitt. der Anth. Gesel. in Wien, vol. xxii., 1892, p. 73.
[2] Niederrh. Gesel. in Bonn, 1892. [3] Revue Mensuelle, 1893, p. 20.

CHAPTER IV.

ON INTERMEDIARY LINKS BETWEEN MAN AND THE LOWER ANIMALS.

Dr Dubois reviews his critics—G. de Mortillet on the situation—The Java Remains considered from a wider standpoint than Anatomy—Erect Position preceded the higher development of the Brain—Dr Keith and Professor Manouvrier advocate this view—Corollaries to this view—Nature of Intermediary Links—Erect Posture the most conspicuous Characteristic of Man—Only the Skull morphologically changed after its attainment—Professor Manouvrier on the Evolution of Man—General Conclusions—Two Stages in the transition of Man from Lower Animals—Present Lower Races are Intermediary Links.

THE publication of Dr Dubois' elaborate report on the human remains lately discovered in deposits of the Upper Pliocene, in Java, as already described, has called forth a large amount of criticism from a number of the most eminent anthropologists throughout Europe. In a recent article in the 'Anatomischer Anzeiger' (vol. xii., 1896), he classifies his reviewers under three groups, according as they have declared themselves in favour of one or other of the following interpretations put on the anatomical features of the calvaria.

1. Those who regard the skull as human:—

W. Turner, Journal of Anatomy and Physiology, 1895, vol. xxix. pp. 424-445.

D. J. Cunningham, Nature, vol. li. 1895, p. 428.
A. Keith, Science Progress, vol. iii. p. 348; and Proc. Anat. Soc., February 1895.
R. Lydekker, Nature, vol. li. p. 291.
Rud. Martin, Globus, vol. lxvii. p. 213.
P. Matschie, Naturwissensch. Wochenschr., vol. x. p. 81.
P. Topinard, L'Anthropologie, vol. vi. p. 605.

2. Those who regard the skull as simian:—

R. Virchow, Verhand. Berliner Anth. Gesel., 1895, pp. 81, 336, and 435; Die Nation, 1895, p. 53.
W. Krause, Ibid., p. 78.
W. Waldeyer, Ibid., p. 88; Anth. Congress Kassel, 1895.
O. Hamann, Gegenwart, January 1895.
H. Ten Kate, Nederlandsch Koloniaal Centraalblad, 1895, p. 128.

3. Those who regard the skull as a transitional form:—

E. Dubois, Jaarboek v. h. Mynwezen in Nederlandsch Indië, 1892; Pithecanthropus erectus, &c., Batavia, 1894; Leidener Zool. Cong., 21st September 1895; Roy. Dublin Society, 20th November 1895; Anth. Inst. of Great Britain and Ireland, 25th November 1895; Berliner Gesellschaft für Anth., 14th December 1895; &c.
L. Manouvrier, Bull. Soc. d'Anthrop., vol. vi., 4th series; Revue Scientifique, vol. v., 4th series, 1896, pp. 289-299.
O. C. Marsh, American Jour. of Science, 1895, vol. lxix.
E. Haeckel, Syst. Phylogenie des Wirbeltiere, p. 633.
A. Nehring, Naturwissensch. Wochenschr., 1895.
R. Verneau, L'Anthropologie, vol. vi. p. 725.
A. Petit, Ibid., p. 726. Previously (Ibid., p. 65) regarded as human.[1]

Looking at the list of distinguished names here marshalled in battle array, it must be allowed that, in

[1] The references here given are from Dr Dubois' paper, but I have not been able to verify them all.

penning the following words, Dr Dubois has scored a point against his opponents, though, perhaps, at the expense of a little pardonable sarcasm :—

"Ein—im Vergleiche mit normalen menschlichen—so kleiner und in seiner Form so affenähnlicher Schädel, dass er von nicht wenigen erfahrenen Anatomen für einen Affenschädel erklärt wurde, kann nicht menschlich sein!"[1]

G. de Mortillet on Dubois' Critics.

But it remains for G. de Mortillet to complete the irony of the situation. This is how he classifies the controversialists in a recent article in the *Revue Mensuelle* entitled "Précurseur de l'homme et Pithecanthrope" :—

La découverte d'Eugène Dubois fit grand bruit. Le soin avec lequel il l'a publié, l'activité qu'il a déployée, et l'heureuse idée qu'il a eue de présenter les pièces originales dans tous les grands centres de travail l'ont fait étudier et discuter de toutes parts. Mais les avis ont été on ne peut plus partagés. Ils se sont tout d'abord parqués par nationalités. Les Anglais, bien que compatriotes de Darwin, ont fait de grands efforts pour démontrer qu'il ne s'agit que d'un homme, un homme très inférieur, mais déjà un véritable homme. Les Allemands, au contraire, se sont froidement ingéniés à prouver qu'il ne s'agit que d'un singe. Les Français ont purement et simplement adopté les déterminations du jeune savant hollandais. C'était chose facile pour des compatriotes de Lamarck. C'était chose d'autant plus naturelle que la division en parts à peu près égales des opinions extrêmes est plus que suffisante pour bien établir qu'on est en présence d'un être intermédiaire.

Dans un article publié en septembre 1896, W. Dames[2] a fait

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[1] Abdruck aus Anat. Anzeiger, vol. xii., 1896, p. 13.

[2] Deutsche Rundschau, September 1896, p. 368.

le relevé de l'opinion de vingt et un auteurs de nations diverses concernant les pièces provenant de Trinil. En voici le résumé.[1]

Indication des pièces.	Attributions à l'homme.	Considérés comme intermédiaires.	Attributions aux singes.
2e molaire . . .	...	5	2
3e molaire . . .	4	8	6
Fémur . . .	13	6	1
Calotte cranienne .	6	8	6

The Java Remains considered from a wider standpoint than that of pure Anatomy.

In these circumstances it may well be asked, How are we to ascertain the real truth of this important matter? Are we to regard the being who owned the Java bones as an ape; or as a specimen of early humanity; or as the long-desiderated "missing link" which was to bridge over the wide gap between civilised man and the lower animals? Or, is it really necessary to formulate these alternatives at all, for may they not indicate one and the same thing, their seeming difference being due to the different standpoints from which the phenomena are contemplated? To form a rational opinion on these problems we must, I fear, cast our eyes beyond the debatable field of petty anatomical distinctions. For, after all, it seems to me that, except in a very general way, human anatomy furnishes but little evidence on the line of the descent of Man.

Shortly after the publication of Dr Dubois' original memoir, Professor Sir William Turner communicated a paper on the subject to the Royal Society of Edinburgh, in which he maintained that the Java skull-cap

[1] Revue Mensuelle, 15th October 1896, p. 313.

presented no specific characters which were not also to be found on other human skulls. "If we accept," says Sir William, "that the Pleistocene deposit in Java, in which this specimen was found, is of the same geologic age as the European Pleistocene, there is nothing in the configuration of the skull-cap to place it in a different category from those remains of human Quaternary Man obtained in Europe, which already have been referred to as possessing similar characters."[1]

The thigh-bone he regarded as human, but its *locus standi*, as evidence, was rejected on the ground of the extreme improbability that it was a thigh of the skeleton to which the calvaria belonged. Subsequently, after having seen the actual bones and heard Dr Dubois' further explanations both in Edinburgh and London, he still adhered to his formerly expressed opinions; but with regard to the thigh-bone he made the following explanation:—

"If, however, the thigh-bone and calvaria belong to the same skeleton, and Dr Dubois, from his personal examination of the locality, has no doubt on this point, the establishment of the human character of the femur would require us to regard the calvaria as also human."[2]

The rationale by which this conclusion is arrived at is not justified, in my opinion, either on logical or anatomical grounds, but, curiously enough, as will be seen by-and-by, I am at one with Sir William as regards the conclusion. Though the premise—viz., that this thigh-bone had all the characters of that of a human

[1] Proc. Roy. Soc. of Edinburgh, vol. xx. p. 436.
[2] Jour. Anth. Inst., vol. xxv. p. 250.

being—may be strictly accurate, it does not necessarily imply that the skull was that of a human being, though as a matter of fact this may also be true. For, indeed, the *raisons d'être* of these two statements are virtually incomparable. The development of the thigh-bone is dependent on a mere adjustment of physical contrivances to slightly altered physical ends. It is a purely morphological change comparable to that by which the bird, the bat, or the whale has converted its limbs to their special purposes by virtue of a law which permeates every department of the organic world. On the other hand, the evolution of the skull is only morphological in a secondary sense, its adaptation—mainly mere expansion—being due to the development or increase of the brain substance in its interior—a process which must be relegated to the mystic laboratory where thought, intellectuality, metaphysics, and other mental phenomena are converted into their material equivalents.

Erect Posture preceded the higher development of the Brain.

When Sir William Turner read his paper I had an opportunity, in the course of the discussion which followed, of remarking that there could be no difficulty in assigning the femur and skull to the same individual, since, in accordance with the doctrine of evolution, the former would have acquired its specific characters long before the latter, because the attainment of the erect posture and the consequent specialisation of the forelimbs into manipulative organs necessarily preceded,

and indeed partly accounted for, the higher mental organisation of man.

I may perhaps be allowed to say that this theoretical explanation is neither novel nor far-fetched, as it will readily occur to any one who carefully considers the chronological sequence of the various stages in Man's evolution. Upwards of three years ago I made this subject the theme of an address which, as President of the Anthropological Section, I had to deliver at the British Association held at Nottingham in 1893.[1] In that address I endeavoured to prove that, with the attainment of the erect posture and the concomitant conversion of the four limbs into hands and feet, the precursor of Man became *Homo sapiens* and introduced on the arena of organic life a new phase of existence in which the manipulative organs became correlated with his progressive intelligence. I showed that by a skilful use of these means this upright being gradually utilised the forces of nature for his own special benefit, and began to manufacture implements and weapons by means of which he, so to speak, became "lord of creation." The application of the fore-limbs to the exclusive function of prehension and manipulation furnished a new stimulus to the reasoning faculties, a process which ultimately led to a remarkable development of the organ of intelligence. For as all mental operations have physical equivalents in brain matter, every new generalisation of the laws of nature widened the mental grasp and capacity of successive generations till, in the course of ages, the acquisition of knowledge and the

[1] See Chap. ii.

quickening of the intellectual powers became stereotyped in the additional brain substance, thus necessitating a comparatively much larger brain-case than that of any other animal now or formerly existing on the globe. The erect posture and a larger brain were, in my opinion, sufficiently characteristic to place man in a separate category at the head of the great chain of organic life.

Similar Views advocated by Dr Keith and Professor Manouvrier.

The full text of this address was at the time published in several scientific journals, and is referred to in Dr Dubois' original memoir. But, notwithstanding, the doctrine itself does not appear to have made much impression on the minds of his eminent critics, as only two of them, so far as I have had access to their productions—viz., Dr Arthur Keith and Professor L. Manouvrier—have even mentioned the idea as a possible explanation of the peculiarities presented by the Java skeleton. The opinions of these two gentlemen are all the more valuable, inasmuch as it does not appear that either of them derived their inspiration from anything previously written on the subject.

Dr Keith[1] thus writes: "It seems to me, however, highly probable that the frame of man reached its perfection for pedal progression long before his brain attained its present complex structure. If one conceives this probable, or even possible, there is no

[1] Science Progress, vol. iii., July 1895, p. 368.

hindrance to awarding the femur to the Bengawan woman."

This, though short, is perfectly explicit in support of the principle of my contention. Professor Manouvrier discusses the question at much greater length, and several passages could be quoted from his writings, but perhaps the following will be sufficient for our purpose:—

L'évolution humaine de ce fémur aurait donc été plus rapide et plus complète que celle du crâne et des maxillaires. Or, cela n'infirmerait en rien les deux hypothèses précédentes. Il est très vraisemblable, en effet, que si une race d'anthropoïdes grimpeurs a pu évoluer vers le type humain sous l'influence de conditions quelconques, l'adaptation de ses membres inférieurs à la marche a dû être rendu libre pour des fonctions autres que la locomotion, les membres supérieurs et déterminé ainsi le progrès cérébral. J'ai déjà insisté ailleurs sur cette remarque.[1]

On trouve, d'ailleurs, actuellement, des races humaines, très arriérées sous le rapport de la forme du crâne, qui ne le cèdent en rien aux races européennes sous le rapport du fémur. Il n'y aurait donc pas lieu de s'étonner de trouver une race humaine tertiaire ou quaternaire plus avancée sous le rapport de l'évolution fémorale que sous le rapport de l'évolution crânienne.[2]

Dr Dubois, also, in his article to the Royal Dublin Society, particularises and adopts these views in the following manner:—

Manouvrier and Dr Arthur Keith point out that the human form of the Trinil femur is not sufficient to prove that it did not belong to the same individual as the skull-cap; for, the

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[1] Mémoires de la Soc. d'Anthropologie de Paris, 2d series, vol. iv.

[2] Bulletins de la Soc. d'Anthropologie de Paris, vol. vi., 4th series, 3d January 1895, p. 33.

phylogenetic evolution of the human femur ought to have preceded that of the skull, as the erect attitude and the erect locomotion have been the cause of the intellectual perfection. Suppose a species of Anthropoid Ape—whose frame rather resembles the human—suppose a large Hylobates should strive to perfect the pedal locomotion, which this genus already has when walking on the ground—it would, on account of the close relation existing between form and function of the femur, be hardly imaginable that this bone could be different from that of man in important characters. In the opinion of Manouvrier, Keith, and myself, there might, therefore, exist a form, the skull of which had still many simian peculiarities, whilst the femur was to be distinguished from the human bone in quite subordinate and mechanically unimportant characters only.[1]

Corollaries to the Theory of the Erect Posture in Man.

If, then, this hypothesis marks a great landmark on the general highway by which man diverged from his quadrupedal ancestors, there are a few well-defined considerations which, as corollaries to the main proposition, ought to guide the investigator in his efforts to trace the details of human development. These may be categorically stated as follows:—

1. The physical transformation which has taken place in the human body was effected through the ordinary laws of nature; and, consequently, the gap between civilised man and the vertebrate, from which he primarily diverged, must have been bridged over by a continuous series of intermediary forms. The point of final contact is, however, so remote that it is difficult to assign his progenitor to any known species either living or extinct. But there is no substantial reason to suppose

[1] Scientific Transactions, vol. vi., 2d series, p. 9.

that it was any of the present anthropoid apes, because this supposition would involve the continued existence of his progenitors, in an unchanged condition, while he himself was passing through a very remarkable transformation. It is, therefore, more likely to have been some extinct species which formed a common ancestor to him and the present anthropoid animals, as advocated by Darwin, Haeckel, and others.[1] But this is a subject in regard to which there is room for legitimate scepticism, for it is quite a feasible view to hold that, while man was accommodating himself to his new sphere of action, the remaining manlike apes were struggling for existence on the old lines, rather receding than advancing in intelligence. But, whatever corporeal alterations the anthropoid apes may have undergone since the human race parted company with them, they do not appear to have improved or enlarged their means of subsistence. Other eminent anthropologists, such as MM. Gaudry and Carl Vogt, advocate the theory that the different races of mankind had different progenitors. But this and other problems of the same speculative character need not be discussed here.

[1] "The early progenitors of man," writes Darwin, "must have been once covered with hair, both sexes having beards; their ears were probably pointed, and capable of movement; and their bodies were provided with a tail, having the proper muscles. Their limbs and bodies were also acted on by many muscles which now only occasionally reappear, but are normally present in the Quadrumana. At this or some earlier period, the great artery and nerve of the humerus ran through a supra-condyloid foramen. The intestine gave forth a much larger diverticulum or cæcum than that now existing. The foot was then prehensile, judging from the condition of the great toe in the fœtus; and our progenitors, no doubt, were arboreal in their habits, and frequented some warm, forest-clad land. The males had great canine teeth, which served them as formidable weapons."—'Descent of Man,' p. 160.

2. In accordance with the now well-established doctrine of the localisation of brain function, the cerebrum, or frontal portion of the encephalon, is universally recognised as the chief seat of the mental endowments which distinguish man from other animals; and as the accumulation of this brain substance was necessarily of slow growth, one would expect the entire series of skulls forming the intermediary links to present frontal prominences less developed in proportion to their antiquity —a fact which is exactly borne out by all the fossil remains of man hitherto recorded.

3. As soon as progressive locomotion was exclusively performed by the posterior limbs, the evolution of the body, with the exception of the brain and its osseous casing, was virtually completed, and it has ever since practically remained *in statu quo*. The lower limbs have continued to perform the same function during the whole course of human existence, and their osseous characters —more especially those of the femur—would be affected very little, whether the individual owned the brain of an ape or that of a philosopher. It would, however, be quite the other way with the brain; for as man progressed in knowledge he relied more and more on his reasoning faculties, so that, during his entire human career, this organ would be subjected incessantly to stimuli of a variable but generally progressive character. The additional brain substance thus accounted for, being deposited chiefly in the cerebral lobes, has produced, not only an expansion of the surrounding cranium, but a backward movement of the occipital region so as to balance the head on the spinal column.

According to these views we should expect to find the fossil bones of the trunk and limbs of man, at all periods of his range in time, much the same as those of modern skeletons; while those of the head would present simian-like characters the more they recede into the dim vista of the past.

4. As man must have assumed the erect attitude before his ingenuity as a tool-maker could be of much account, it is manifest that the existence of fashioned implements, such as those palæolithic flint implements found in the ancient river-gravels in this country and elsewhere, implies a being already possessed of a skilled hand and no small amount of reasoning intelligence. Hence we may infer that the beings who manufactured and used them were men similar to those of the present day, the chief difference being that the former had a low retreating forehead, and of course a correspondingly lower degree of intelligence. In these early days the means of advancement were probably restricted to discovering and utilising the forces of the material world around them; but, by degrees, the path broadened so as to embrace language, abstract ideas, and ultimately all the intricacies of literature and philosophy.

5. Looking at the evidence of man's evolution from a purely archæological standpoint, there can be no doubt that the relics which he has left behind him—implements, weapons, ornaments, and other products of his mechanical genius and skill—are characterised by a progressive improvement in technique and workmanship, and present a graduated scale from the rudest forms up to the most perfect mechanical appliances of modern

times. Such relics may, therefore, in a general way, and after making due allowance for exceptional circumstances and degradations due to local causes, be taken as a fair gauge of the progress of humanity.

Nature of Intermediary Links.

These general considerations will enable us to approach the question of the intermediary links—which undoubtedly in former times existed and connected man with the rest of the organic world—with more definite notions as to the kind of evidence to be looked for. And, first of all, we must endeavour to define the line of demarcation which separates man from the lower animals. In applying the term *sapiens* as a specific quality of the genus *Homo*, it is clear that it is too elastic to be used as a precise definition, because it shades off by an imperceptible gradation into the mental manifestations of many of the lower animals. Nor are there any anatomical characters of the brain peculiar to man yet discovered which are not also, in a more or less degree, represented in one or other of the anthropoid apes. Professor Owen's attempt to separate the genus *Homo* from all other animals, on such grounds, has long since been shown to be untenable. But from his failure it does not necessarily follow that differences, sufficiently wide to be classified as generic, do not actually exist. The late M. de Quatrefages, who of all anti-Darwinians was most tolerant to the doctrines of evolution, defines Man as a being possessed of all the attributes of the animal world *plus* the three following

qualities: (1) Man has the *perception of moral good and evil* independently of all physical welfare or suffering; (2) Man *believes in superior beings* who can exercise an influence on his destiny; (3) Man *believes in the prolongation of his existence after this life.* But granting that these attributes, when looked at from the culminating point of modern civilisation, are fundamental distinctions, we are unable to utilise them for classificatory purposes, because neither physiologists nor anatomists have, as yet, pointed out their physical equivalents in the brain-substance.

Erect Posture a distinguishing characteristic of Man.

In these circumstances the erect posture is, in my humble opinion, the most conspicuous boundary line that can be drawn between man and the lower animals. It is not only a specific character of the former, but the actual starting-point of the novel principles and methods which underlie the whole fabric of human civilisation. It is, moreover, as fixed a landmark in organic evolution as the poles of the earth are in geography. The angle which the axis of the vertebral column forms with that of the supporting limbs of an animal varies from 90° to zero. In man alone does this angle reach zero or the vanishing point, by the vertebral axis coming into line with the vertical direction (that of the supporting limbs). This is the final goal of all possible variations aiming at perfection through mechanical and morphological adaptations, as in this position all the parts of the body come into equilibrium and are balanced on two pivots.

Only the Skull morphologically changed after the attainment of Erect Posture.

Thus we are led to the conclusion that, notwithstanding the long ages that have rolled by since man acquired the erect posture, no material structural changes have taken place in his body, with the exception, as already explained, of the head bones, and perhaps some slight modification of the upper limbs entailed by their more complicated function in civilised life. It is, therefore, to his condition as a non-upright animal that we must look for the main anatomical links which connected him with the lower animals. Now, since it is quite possible that the common ancestor of both had approached nearer to the erect posture than any of the anthropoid animals of the present day, it may be plausibly maintained that the latter have not only not held their own, but have actually reverted more to quadrupedal methods of locomotion, so that the gap might have been then actually less than it now appears. But, even without this supposition, the transition from a semi-erect attitude, such as that of the gorilla or gibbon, cannot be regarded as a very great or difficult process in morphological evolution; nor is it necessary to assign to it a long period of time.[1] Moreover, its *modus*

[1] Dr Cleland, in his very suggestive article on *Terminal Forms of Life*, makes the following remarks on the point now at issue: "There is no possibility of doubting that the animals most nearly approaching him [man] are the apes, and that among these the orang and the gorilla are the highest. So far as the skull is concerned, the orang is decidedly nearer to the human form than the gorilla. Different naturalists hold different

operandi might have been due, in the first place, to some favourable alterations in the environments, rather than to natural selection by the survival of the fittest. Indeed the use of sticks and stones, as weapons of offence and defence, would almost necessitate an upright attitude. Once the contending animals realised that pedal locomotion was advantageous, we can easily conceive that among a multitude of combatants the transformation of the posterior limbs into suitable feet would be rapidly effected. And it would be all the more so if they had, for some reason or other, abandoned their arboreal habits and taken to the open plain; for then, not only the principle of selection by survival of the swiftest, but also imitation, would come into requisition. Evolutionary stages often run in grooves, and may be slow or rapid, long or short, in proportion to the urgency of the inciting causes and the benefits conferred by the change. The transition period from the semi-erect to the erect posture cannot therefore, in point of duration, be at all paralleled with the long ages since the transformed being has lived on the globe. It is also most probable that this transformation took place in a limited area, so that the chances of finding the fossil remains of a representative of this stage are extremely small.

opinions as to the importance of the gap between the structure of these animals and the human body; but there can be no doubt of this, that they lie nearly in the line between monkeys and men. They are not divergent; on the contrary, the arboreal peculiarities of the monkeys are less extreme in them. Neither are they termini of form. But man is a terminus, and not only *a* terminus but *the* terminus of the advance of vertebrate life."—'Journ. Anat. and Phys.,' vol. xviii. p. 359.

On the other hand, the probability of finding specimens of erect beings, with crania in all grades of development from a slightly changed simian type up to that of civilised man, is enormously greater, not only on account of the length of time since they came into existence, but because of their early and wide distribution on the globe. For the relics of palæolithic man are not confined to any quarter, and this is another proof that, even at this early stage, he had the capacity and knowledge to accommodate himself to the vicissitudes of climate. Whatever may have been the precise circumstances which compelled the first colony of anthropoid animals to resort to bipedal locomotion, the perpetuation of the habit soon became hereditary, and has since produced results unparalleled within the whole range of organic life.

Professor Manouvrier on the Morphological Changes consequent on the assumption of the Erect Posture.

After the above remarks had been written I happened to read the paper by Professor Manouvrier in the 'Revue Scientifique' (March 1896), in which he propounds similar views on this phase of man's evolution to those here advocated; so much so, indeed, that had not my general opinion on the subject been already published, I should probably be suspected of plagiarism. Manouvrier's arguments are, however, more elaborately stated than mine, especially where he urges that while the organic changes due to the habitual assumption of bipedal locomotion would be

rapidly acquired, the brain would respond to the manipulative functions of the hands much more slowly. On the first of these points he thus writes :—

La transformation du mode habituel de locomotion a pu être très rapide, mais les transformations morphologiques consécutives ont dû demander beaucoup du temps et n'ont pu être fixées héréditairement qu'après un certain nombre de générations. Des centaines peut-être, mais peut-être beaucoup moins, car la selection dans les conditions indiquées plus haut a dû être des plus actives; les deux sexes ont dû contribuer activement à la progression et les jeunes ont dû imiter leurs parents avec une facilité toujours croissante. En ce qui concerne les conséquences morphologiques *directes* de l'attitude bipède, on peut présumer que ces conséquences mécaniques se sont produits avec une grande rapidité, si l'on en juge d'après les multiples variations squelettiques déterminées chez l'homme sous l'influence de variations fonctionnelles minimes relativement à celles que nous envisageons ici.[1]

In this same article the eminent Parisian anthropologist suggests that the destruction of the Java forests by some volcanic catastrophe—a phenomenon which the geologic records prove to have been of frequent occurrence in the island in Tertiary times—might have been the means of compelling a large-sized species of gibbon to resort to the erect attitude, and thus to accommodate himself in the best way possible to the circumstances arising from this unforeseen calamity. This hypothesis, with equal probability, might be extended so as to include the supposition that in such, or analogous, conditions there were two species of manlike apes, both of which assumed the erect attitude as a result of frequent and mortal combats for supremacy.

[1] Revue Scientifique, vol. v., 4th series, 1896, p. 297.

It is not inconceivable that a powerful leader among one or other of the combatants might have distinguished himself by rushing on his enemies in a rampant attitude, wielding a piece of wood which he could even then well grasp, and thus by a combination of strategy and physical strength put them to flight. The heroic deed would be quickly imitated by foes as well as by friends, and in future his method would become the recognised mode of warfare. But these are mere speculations which it would be dangerous to pursue to greater length.

General Conclusions.

From the above brief review of the natural phenomena, which have hitherto guided and controlled the destinies of mankind, I would venture to formulate the following conclusions, not in the spirit of dogmatism, but in that of a very imperfectly equipped student in search of the truth:—

1. In the evolutionary career of man two stages are to be recognised: firstly, the stage during which his physical transformation was being effected so as to adapt him for the erect posture and bipedal locomotion; and, secondly, that during which his mental organisation developed to the extent of becoming a new governing force in the organic world. The one being mechanically advantageous, and readily effected according to the laws of morphological adaptation, had a short duration. The other, an extremely slow process, consisted of infinitesimally small increments

of knowledge, acquired by repeated experiences of reasoning from cause to effect and from means to ends. As corroborative evidence of the current mental phenomena during this long stage we have a series of fossil skulls showing, in chronological sequence, a gradual abandonment of simian or pithecoid characters up to the normal human skull of the present day. Further, in the great variations both as to form and capacity of the skulls of existing human races—viz., 62 cubic inches (1016$^{cc.}$) as the lowest, and 114 cubic inches (1868$^{cc.}$) as the highest[1]—we have a series of living intermediary links as survivals of ancient races which have been pushed into the side eddies of the great stream of evolution. All these will finally die out, when forced into competition with higher races, or when deprived, either by natural or artificial means, of the placid environments to which they owe their continued existence. For this reason the arguments against man's evolution, advanced by many anatomists on the ground that Neanderthaloid characters are occasionally to be met with on the skulls of modern races, seem to me rather in favour of, than antagonistic to, this doctrine.

2. No reliable inferences as regards intelligence can be drawn from the comparison of skulls in respect of their internal capacity, because the size of the brain bears a proportional relation to the size of the individual. Moreover, the cranium, in the living being, is occupied by a compound organ harmoniously arranged with reference to the proper distribution of its sub-

[1] Huxley's Collected Essays, vol. vii. p. 107.

organs and their varied functions. Hence the difference in actual bulk between the brain of a very small and that of a very large person would by no means give a correct idea of the respective intellectual abilities of these two persons, because we have no means of correctly defining or identifying the localised portion of the brain from which the higher mental manifestations proceed.

3. Taking the Java skull at Dubois' estimate of 1000$^{cc.}$, that of an average European at 1500$^{cc.}$, and that of a gorilla, from a specimen in the University of Edinburgh as stated by Sir William Turner,[1] at 590$^{cc.}$, we observe that *Pithecanthropus erectus* stands about half-way in point of brain capacity between modern man and the gorilla. Now, if the geological horizon of the Java man is correctly ascertained to be the border-land between the Pliocene and Quaternary periods, we can form some idea how far we have to travel backwards to reach that of the common stock from which men and apes have sprung.

4. If we accept the erect posture as the line of demarcation between man and the lower animals, the Java skeleton undoubtedly comes under the category of human; but if this Rubicon is to be defined by any degrees of mental phenomena, then the attainment of the erect position is of no classificatory value, as it must have been long after the occurrence of that event that man's religious, moral, and intellectual faculties became characteristic qualities. Hence, from the latter standpoint, Dr Dubois' opinion—viz., that the Java

[1] Journal of Anat. and Physiol., vol. xxix. p. 436.

fossil bones are the remains of a transitional form which cannot well be regarded as either an ape or a man—is essentially correct.

5. On the supposition that the development of man was from one centre, and dispassionately estimating the finger-point indications of such of his fossil remains as have hitherto come to light, there appears to have been ample scope both for the rise of the various races of mankind and for their distribution into all parts of the habitable globe. It has already been pointed out that the persistency of the most characteristic distinctions of the present-day races forces us to assign to man the vast antiquity involved in the extension of his origin to, at least, the time when the black-, white-, and red-skinned people converged in a common ancestor; and it is satisfactory to find that this ethnological evidence is corroborated by the deductions just formulated on totally different grounds. As intermediary links all these fossil remains present merely different stages in the history of mankind; but it is important to observe that the farther back the investigation leads us the more simian-like does the brain-case become—a fact which suggests a corresponding degradation in mental endowments.

PART II.

ARCHÆOLOGICAL

CHAPTER V.

PREHISTORIC TREPANNING AND CRANIAL AMULETS.[1]

Preliminary—Trepanned Skull of the Bronze Age from the island of Bute—Discoveries of Dr Prunières and others in France—Dr Broca's famous Memoir—Trepanned Skulls and Amulets rapidly discovered throughout Central Europe—Trepanning among various Primitive Races—Method of operating in Stone Age—Dr Broca's Hypothesis as to its Object—Posthumous Operation and Cranial Amulets—Additional Discoveries—The T Sincipital.

SINCE the investigation of the unwritten records of man on scientific methods commenced, many novel if not startling deductions have gradually found their way into current philosophical beliefs. The long-settled mists, which like an impenetrable barrier bounded the mental vision, are now fast breaking up, and through great rifts here and there we can distinctly trace the trail of humanity, till it again disappears on the more distant horizon of geological remoteness. Before the historic dawn in Europe neolithic civilisation, which in my opinion differed only in degree from that which now prevails, held sway for many ages. The people of this period reveal by the character of their remains—their

[1] The larger portion of this chapter appeared in the 'Fortnightly Review,' February 1893.

implements, tools, weapons, ornaments, buildings, tombs, &c.—that, at least in adaptive genius and manipulative skill, they were in no respect inferior to their modern successors. By the industry and researches of archæologists, more especially since the discovery of that remarkable class of remains known as *Lake-dwellings*, we have materials from which their entire life-history can be reconstructed. They are here disclosed as a navigating, building, commercial, pastoral, and agricultural people, and possessing a knowledge of various arts, industries, luxuries, and amusements. Their well-developed skulls show that in actual brain-capacity evolution had already done its work. To estimate the quality of this brain-work is, however, a more subtle problem. However comprehensive and vivid the picture of their civilisation may be, it gives but an imperfect insight into their culture and higher mental, moral, and metaphysical qualities. It is from this aspect that the facts and speculations popularly depicted in this chapter derive whatever importance they may possess beyond novelty and curiosity. They afford us a passing glimpse into the religiosity, or, as some would call it, superstition, of the men of the Stone and Bronze Ages. So far it corroborates the opinion, already surmised from the attention paid to the structure of the tomb and the kind of objects deposited therein, that the most powerful and dominating influence in the creed of prehistoric man in Europe was a belief in the supernatural and in the existence of a future state.

Trepanned Skull from the Island of Bute.

A few years ago the Marquis of Bute presented to the National Museum of Scotland some portions of the osseous remains of a human body, which were taken out of an ancient sepulchral cist, near Mountstuart House, on the island of Bute. Along with these bones were found an urn (Fig. 73), decorated with linear zigzag and the so-called herring-bone patterns; a necklace (Fig. 74) made of jet beads and plates, the latter being also ornamented with punctured dots, linearly arranged so as to enclose angular spaces; and a small piece of thin bronze of an indeterminate character —all of which justify the opinion that the interment took place in the early Bronze Age. According to Dr Beddoe and other competent authorities who examined these bones, their owner was a young woman, whose wisdom teeth had not yet appeared when she was summoned to quit this life.

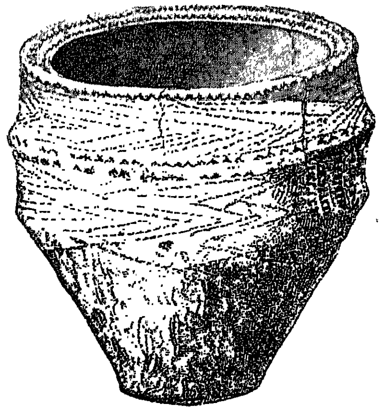

Fig. 73.—*Urn from Cist at Mountstuart, Bute* (¼).

The remarkable and special point in this "find" which has attracted my attention is a cup-shaped hollow on the left side of the frontal bone, and having in its centre a small perforation (Fig. 75). This singular looking concavity is situated immediately above the

temporal *fossa*, and its anterior margin is exactly one inch above the outer angle of the orbit. Its exterior

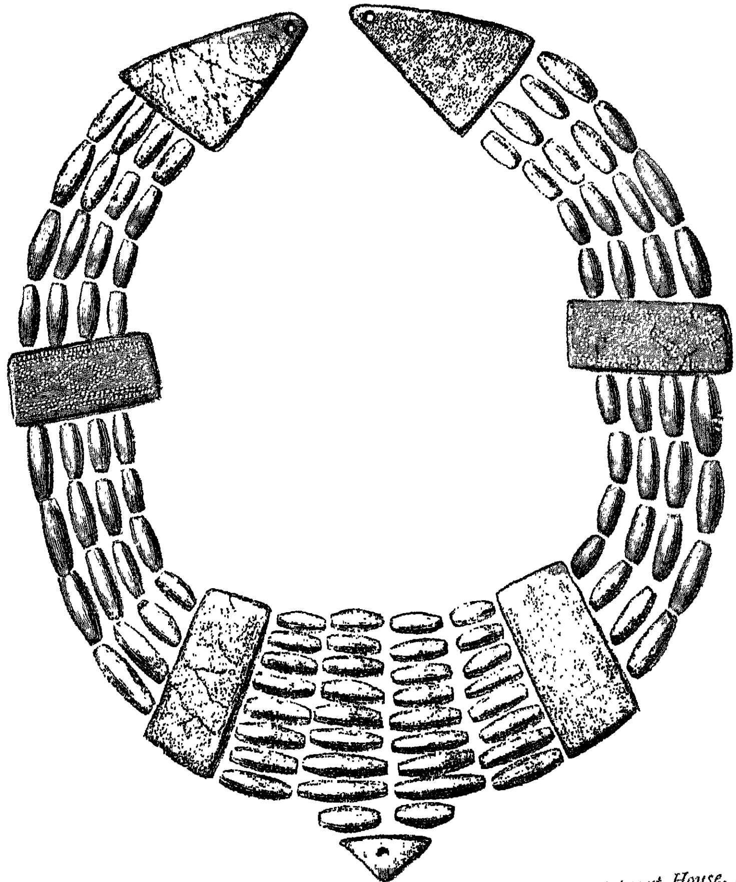

Fig. 74.—*Necklace of Jet Beads and Plates from Cist at Mountstuart House, Bute.*

edge, which measures about an inch in diameter, is slightly raised above the normal surface of the surrounding bone, thus presenting the appearance of an everted lip. This latter feature is particularly noteworthy,

because it is undoubtedly the result of a pathological process which could only take place in the living body. The actual perforation takes the form of a bluntly defined triangle, bounded by thin edges, and its greatest diameter does not exceed a quarter of an inch. From a careful study of these facts, together with the knowledge that many similar examples had been observed in various parts of Europe, I had no hesitation in coming to the conclusion that this perforation had been inten-

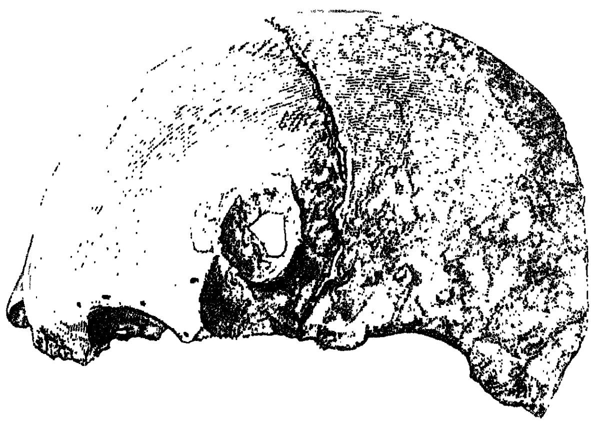

Fig. 75.—*Skull from Cist at Mountstuart, Bute* (½).

tionally performed on the living subject; that the subject survived the operation, possibly for many years; and that the operation had been performed by the laborious process of scraping the bone with a sharp piece of flint until a complete perforation of the skull had been effected. But however correct these inferences may be, the evidence of a single example—the only one to my knowledge hitherto recorded within the British Isles—is inadequate to prove the wider generalisation

which it is my object in this communication to substantiate—viz., that trepanning the human skull for therapeutic purposes was not an uncommon surgical operation among the neolithic inhabitants of Europe long prior to the introduction among them of the metals from which the implements, so essential to the modern surgeon, are now made. Such a generalisation can only be based on a large number of instances widely distributed both in space and time. Happily the materials for the successful advocacy of this proposition, especially as regards France, are already at hand, so that it only remains for me to associate this British example of trepanning with analogous discoveries elsewhere in Europe.

Discoveries of Dr Prunières and others in France.

The successive steps in the remarkable series of inductive inferences which, as the sequel will show, have culminated in the above curious generalisation, furnish us with a most admirable illustration of the methods by which the science of prehistoric archæology has attained its present distinction. The starting-point of the investigation dates back to an incident that occurred at the French Association for the Advancement of Science, held in August 1873, at Lyon. Dr Prunières, a physician of the town of Marvejols (Lozère), already well known for his researches among the dolmens in his neighbourhood, exhibited at the anthropological section of that meeting an oval piece of bone, 2 inches long by 1½ broad, artificially made from the parietal bone of a human skull. The two surfaces of this *rondelle* were

natural, but its surrounding margin was bevelled at the expense of the upper surface and worked with care along its entire perimeter (Fig. 76). It was found by Dr Prunières inside a human skull which he had taken from one of the neighbouring dolmens. This skull had a large lateral aperture about the size of a man's hand, and its interior was filled with earth. It was while removing this earth through the said aperture that the *rondelle* dropped out. The first idea that suggested itself to Dr Prunières was, that this worked piece of bone had been the lacking part of the skull, but upon careful comparison of the two he came to the conclusion that this could not have been the case, as they differed in colour, density, and thickness. There was, therefore, no alternative to the opinion that it had been intentionally placed there, but for what purpose was to him a complete enigma.

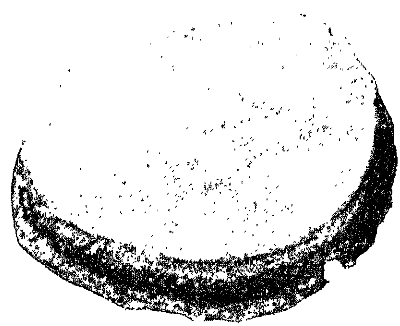

Fig. 76.—*Amulet made of a portion of a human skull from a dolmen in Lozère. Coll. Prunières* (½).

Among the anthropologists then assembled at Lyon this bit of bone excited no small amount of curiosity, but they could offer no rational explanation of its meaning, as none of them had ever before seen anything of the kind. Ultimately Dr Prunières suggested that it might be an amulet—a suggestion which became somewhat strengthened in his mind by recollecting that, in the course of his explorations, he had seen other

cranial portions which, it then occurred to him, might have been used for a similar purpose. On his return home he searched through his large collection of bones and came upon a fragment which, though very dissimilar to that exhibited at Lyon, furnished him with a corroborative link in the amulet theory as to the use of such relics. This new amulet (Fig. 77) had neither an oval shape nor a skilfully worked margin. It had, however, a notch at two opposite sides and a groove on both surfaces connecting the notches, —an arrangement which evidently was for the purpose of enabling the owner to carry it about with him suspended by a string.

Fig. 77.—*Amulet made of a portion of a human skull from the dolmen of La Cave des Fées (Lozère)* (½).

During the ensuing winter months Dr Prunières collected a large number of additional specimens of these cranial amulets, as well as skulls showing artificial loss of substance. These materials he worked up into an important memoir, which was read on the 5th of March 1874 at the Anthropological Society of Paris. From this communication it would appear that Dr Prunières, as early as 1865, found in a dolmen near Aiguières a cranium from which an enormous portion had been intentionally removed, the artificial character of this operation being clearly indicated by marks of cutting and sawing all round the margin, except on one small portion which looked as if it had been polished by friction of some kind. At that time Dr Prunières enter-

tained the belief that this skull had been so fashioned for the purpose of being used as a drinking-cup—a purpose traditionally ascribed to the Scythians, Gauls, and various savage races. In the same sepulchre he collected no less than five cranial fragments, all more or less worked, which he considered to have been the *débris* of ancient cup-makers. As soon, however, as the amulet-theory was broached he abandoned this idea, and henceforth looked upon all the perforated skulls as the work of amulet-makers.

While these investigations were being vigorously prosecuted in the south of France, Dr Paul Broca, who, by the way, was quite conversant with the results of Dr Prunières' researches, was invited by Baron de Baye to visit the artificial caves, then newly brought to light and investigated by him, in the valley of Petit-Morin (Marne). These caves were rectangular chambers cut out of the soft chalk, and, as it would appear, were partly used as dwellings and partly as sepulchres. The people who lived and died in them belonged entirely to the Neolithic period, a fact which was amply demonstrated by the kind of relics collected. Dr Broca's visit to Petit-Morin was made in company with MM. de Mortillet and Lagneau (just at the very time that Dr Prunières had forwarded the above-mentioned memoir to Paris), and its special object was to examine some very rude, but curious, sculpturings of human figures and other objects in bas-relief, which were to be seen on the walls of some of the chambers. After inspecting several of the caves these savants were conducted to the Château de Baye, where the skulls, bones, and other

relics, collected in course of the explorations, were carefully preserved, and formed, in the words of Broca, "un véritable musée." In one of the cases they were shown a *rondelle* made out of a human skull, which was at once recognised as analogous to the one exhibited at Lyon, differing from the latter only in being pierced with a small hole for suspension.

To Dr Broca himself must be ascribed the next, and perhaps the greatest, step in advance towards the solution of these novel researches. On his return to Paris he carefully examined the specimens sent by Dr Prunières to the Anthropological Society, and for the first time recognised that the so-called polished portions round the margin of some of the cranial amulets and perforations were not the effect of any polishing process, but were due to cicatricial deposits, the result of a pathological action in the living body. With this clue he was able to perceive clearly that many of the remains so manipulated indicated two separate interferences on the part of man, one before and the other after death — two operations which he designated as *trépanation chirurgicale* and *trépanation posthume.*

This important discovery gave a wider interest to these cranial investigations, and henceforward French archæologists were busily employed in collecting and recording additional facts. At a later period of the same year (August 1874) Dr Prunières read another memoir on his discoveries at the meeting of the Association for the Advancement of Science, then held

at Lille. Also at the meeting of this Association held in the following year at Nantes, the subject was reopened for discussion by MM. Chauvet and Gassies. M. Babert de Jouillé, Conservator of the Prehistoric Museum at Niort, published a *brochure*, the purport of which was to show that a perforated skull found in 1840 in the Dolmen de Bougon (Deux-Sèvres), and which was still preserved in the museum, was a case of surgical trepanning. This skull, when discovered, had been examined by Dr Sauzé, who, it seems, came to the conclusion that the perforation was the result of a battle wound which had not immediately proved fatal. Also Baron de Baye, having carefully scrutinised the extensive materials in his possession, published early in 1876 a pamphlet entitled 'La Trépanation Préhistorique,' in which he showed that at Petit-Morin there were not only several amulets, some perforated (Fig. 78) and others unperforated, but also a number of skulls from which part of their substance had been intentionally removed. Nor did the subject lie dormant in the hands of Broca. Among the large osteological collection in the museum attached to his laboratory in Paris was a series of skulls from the famous sepulchral cavern, "de l'Homme Mort" (Lozère), a report of which he had already published in the 'Revue d'Anthropologie' for 1873. All these skulls were of an extremely dolichocephalic type, and two or three

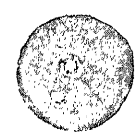

Fig. 78.—*Cranial amulet from Petit-Morin. Coll. Baron de Baye* (⅘).

of them he now recognised as examples of surgical trepanning (Fig. 79).

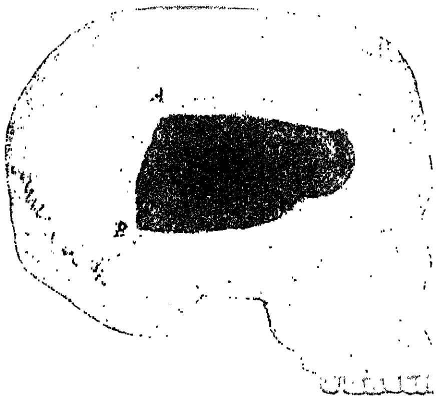

Fig. 79.—*Skull from the Cavern de l'Homme-Mort (Lozère). Coll. Prunières. The portion of the aperture A B was trepanned during life, the rest after death.*

Dr Broca's famous Memoir.

Such was the general progress and tendency of these investigations when the International Congress of Anthropology and Prehistoric Archæology was held at Buda-Pesth in September 1876, at which Dr Broca, in a most masterly manner, reviewed the whole subject up to date. The paper was entitled "Sur la Trépanation du Crâne et les Amulettes Crâniennes à l'Époque Néolithique,"[1] and its general purport is thus defined by the author:—

> I propose to establish the two following facts.
>
> During the Neolithic period a surgical operation was prac-

[1] On February 8, 1881, Miss Buckland read a paper at the Anthropological Institute of London, "On Surgery and Superstition in Neolithic Times," in which she gave a *résumé* of Dr Broca's views on this subject.

tised which consisted in making an opening through the skull for the treatment of certain internal maladies. This operation was almost, if not indeed exclusively, practised on children (*trépanation chirurgicale*).

The skulls of those individuals who survived this *trépanation* were considered to be possessed of particular properties of a mystic order, and when such individuals died *rondelles*, or fragments, were often cut from their skulls, which were used as amulets, and a preference was given to those cut from the margin of the cicatrised opening (*trépanation posthume*).

At the conclusion of this communication, Professor Virchow announced himself as a convert to Dr Broca's opinions. "Je ne crois pas," said he, "que l'on puisse donner aucune autre explication de ces faits. Nous avons gagné par là un nouveau territoire à la science, et je constate que nous venons de faire un grand pas dans l'anthropologie préhistorique."

Trepanned Skulls and Amulets rapidly discovered throughout Central Europe.

The almost immediate effect of the publicity and interest given to the subject by Broca's exhaustive memoir and specimens was to deprive France of her monopoly in these researches. Since then, examples of trepanned skulls and cranial amulets have been announced from nearly every kingdom in Europe. Nor do they appear to be restricted to any particular race or period. Skulls, showing undoubted evidence of having been subjected to the operation of trepanning during life, are found among dolichocephalic and brachycephalic races, while their chronological range

embraces all phases of European civilisation, from the earliest neolithic period down to the dawn of historic times. In France the recorded instances have so increased that, except for statistical purposes, they almost cease to be of significance. M. de Nadaillac[1] informs us that in 1885 the collection of Dr Prunières alone contained 167 specimens of perforated skulls or

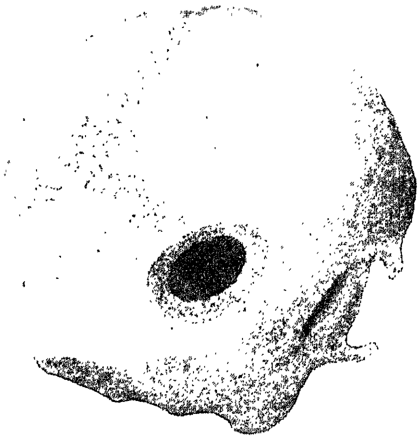

Fig. 80.—*Trepanned skull from Petit-Morin. Coll. Baron de Baye.*

fragments of such skulls. Writing in 1888, Baron de Baye[2] states that the neolithic stations of the Marne district yielded eight skulls in a perfect state of preservation, which had suffered more or less of a loss of substance, the intentional character of which could not be disputed. One of these (Fig. 80) is that of a young person (brachycephalic), and shows an oval perforation over the right lambdoidal suture measur-

[1] Bull. de l'Acad. des Inscript. et Belles-Lettres, vol. xiv., 4th series, p. 281.

[2] L'Archéologie Préhistorique.

ing $1\frac{3}{4}$ by $1\frac{3}{8}$ inch. There is no trace of cicatrisation although the orifice has the characteristic bevelled margin, and hence we must conclude either that the individual died during the operation, or that the operation was a post-mortem performance. Another, that of a full-grown person (mesocephalic), had the operation performed right across the coronal suture. The perforation measured about $1\frac{1}{4}$ inch in diameter, and it was clearly proved by Broca that the patient survived the operation for a long time. A third example (brachycephalic) had a perforation in the left parietal bone about an inch behind the coronal suture, somewhat similar in size and appearance to that just described. This skull indicated an aged person, and the lesion had completely cicatrised. A fourth skull, also that of an aged person (Fig. 81), shows that it had been twice operated on, and that the individual had survived both operations. The two perforations are close together on the left parietal bone, and one of them is very large, measuring no less than $2\frac{1}{8}$ by $1\frac{3}{4}$ inches. Of the entire series of trepanned skulls from Petit-Morin, only four showed that the individuals survived the operation; the rest had the appearance of having been operated on after death. As an illustration of the extent to which these post-mortem interferences were carried,

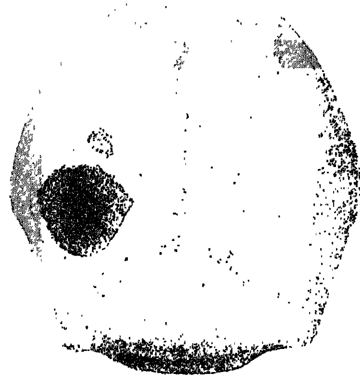

Fig. 81.—*Trepanned skull from Petit-Morin. Coll. Baron de Baye.*

Baron de Baye figures one skull from which the entire upper portion of the cranium had been sawn or cut away.

As to the cranial amulets in Baron de Baye's collection, some were round discs, like buttons, perforated with two small holes, one was roughly triangular in shape with a highly bevelled margin, while the remaining ones were of different forms.

Out of forty-four selected typical skulls from the caves of Petit-Morin sent to Broca for examination, twenty-eight belonged to males and twenty-four to females, while two were uncertain. Also, of this number four were brachycephalic, with an index not less than 83·33; ten were dolichocephalic, with an index not exceeding 75; and the remaining thirty ranged in regular gradation between these extreme points.

The sepulchral caverns of Baume-Chaudes (Lozère), explored by Dr Prunières, yielded an enormous quantity of human bones. The number of *rondelles* and trepanned skulls from this vast ossuary amounted to sixty. Among them was detected a curious relic made of the skull of a deer, which, being circular and perforated, was supposed to have been a forged amulet. The people represented by these remains appear to have been an unmixed race of an extremely dolichocephalic type, having a cephalic index of 70 to 73. Out of the sixty entire skulls collected there was not one of a brachycephalic type.[1]

The discovery of a portion of a skull in the rock-shelter of Entre-Roches, near Angoulême, showing

[1] Bull. de la Soc. d'Anthrop., p. 206, 1876.

marks of having been trepanned, led to some controversy, as it was first reported to have been found associated with characteristic relics of the palæolithic period. This assertion was, however, quickly disproved; but the case is interesting as furnishing some evidence that the operation had been performed for the purpose of removing a necrosed bone. If this opinion be well founded, the patient must have succumbed to the operation, as there were no signs of a cicatricial separative process having begun.[1]

In a series of artificial caves at Tertre-Guerin (Seine-et-Marne) a large assortment of the industrial remains of an early neolithic people has been brought to light, consisting of stone axes, flint implements, hammer-stones, horn casings, and many other portions of worked horn and bone. This race, judging from their osseous remains, would appear to have been strong and muscular, but of a somewhat low type. Several of the leg-bones showed various degrees of platycnemism, the olecranon process of the arm-bones being pierced in the proportion of 24 per cent, the eyebrows were prominent, the chins square, and the face prognathous, &c. Only one skull, belonging to the male sex, was so perfect as to give correct measurements for determining the cephalic index, which in this instance turned out to be 82; but another, that of a female, gave an index as high as 86·50, figures which, of course, indicate a highly brachycephalic race. But the most interesting specimen among these osseous remains was a portion of an aged man's skull, showing on its crown a tre-

[1] Bull. de la Soc. d'Anthrop., p. 12, 1877.

panned aperture about 1½ inch in diameter. The margin of this perforation was very much bevelled, its surface was smooth and velvety, and its cellular tissues were greatly infiltrated with cicatricial deposits.[1]

Dr Wankel[2] describes a very interesting case of trepanning from the grotto of Byciskala, in Bohemia. Here in the course of some exploratory excavations the skeleton of a girl about twelve years of age was disinterred. The body had on each arm a bronze bracelet, and near the neck lay some beads of green glass. The skull was brachycephalic, and presented clear evidence of having been trepanned on the right side of the frontal bone, but the wound showed only slight traces of cicatrisation. The actual perforation was small, only about half an inch in its greatest diameter, but the depression scooped out of the bone exceeded an inch in diameter. The case, indeed, bears a striking resemblance, both in the site and appearance of the perforation, to the Scottish example from Mountstuart, figured at the commencement of this chapter.

In 1881 Professor Parrot[3] described an interesting case of trepanning from the neolithic cemetery of Bray-sur-Seine. The tissues surrounding the perforation in this skull exhibited some special pathological phenomena which, in the Professor's opinion, justified the inference that the operation had been performed for a purely surgical purpose, probably to give exit to accumulated pus. Around the seat of the operation

[1] Matériaux, vol. xii. p. 317, 1877.
[2] Mitt. der Anth. Gesel. in Wien, 1876-77.
[3] Bull. de la Soc. d'Anth., p. 104, 1881.

there was evidence of an extensive ostitis, the cause of which he assigned to a traumatic wound.

A skull found by M. Gaillard in one of the dolmens of Port-Blanc at Saint-Pierre de Quiberon (Morbihan), and described by him in 1883, presented an artificial aperture measuring 2⅜ by 2 inches. The margin of this opening indicated that the bone had been removed on one side by a scraping process, while the opposite side showed an abrupt edge as if a cutting instrument had been used.[1] Dr Parrot, who carefully examined this specimen, came to the conclusion that this operation was also of a surgical character, and had been performed to relieve pressure on the brain due to pus, which had accumulated in consequence of a wound.[2]

In the sepulchral chamber of a tumulus in the Commune de Guisseny (Finistère), a trepanned skull was found associated with a rude urn to which four handles were attached, a bronze poiniard, and some other articles of bronze. The skull had on its right side an oval-shaped perforation 1 inch long by ⅝ of an inch broad, which displayed abundant traces of cicatricial deposits.[3]

From a dolmen near Sainte-Affrique (Arveyron) M. Cartailhac extracted a small brachycephalic skull having two artificial perforations, one of which he considered to have been executed before and the other after death. This skull was one of four from the same dolmen, and among the other human bones were platycnemic tibias

[1] Fouilles des Dolmens du Port-Blanc, p. 7.
[2] Dictionnaire des Sciences Anthropologiques, p. 1073.
[3] Mémoires de la Soc. d'Émulation des Côtes-du-Nord, 1883.

and perforated olecranons. The associated relics were scanty, but decidedly neolithic in their character. In many respects the race of people here represented resembled that inhabiting the caves of Tertre-Guerin already referred to.[1]

Another example of double trepanning has been notified by Dr Topinard from the sepulchral grotto of Feigneux (Oise). This was a dolichocephalic skull which showed traces of an operation before and after death.[2]

A trepanned skull, that of an old man, from the tumulus of Lizières (Deux-Sèvres), discovered by Souché, has given rise to a considerable amount of discussion among anthropologists. MM. de Mortillet, Berchon, de Quatrefages, and Prunières, having carefully examined it, came to the conclusion that the operation had been begun, but only partly performed, during life, that it was then suspended for a time, and subsequently completed at or immediately after death. The form of this perforation was that of a parallelogram, and this, together with some marginal markings, enabled these *savants* to agree on the opinion that the instrument used was made of metal, and that the method of manipulation was a gentle sawing process.[3]

In the year 1886 there were two skeletons exposed in a grave at Limet, near Liége, over which an enormous stone slab lay as a covering. One of these bodies was observed to have its skull trepanned. The only relics

[1] Bull. de la Soc. d'Anth., Lyon, 1883.
[2] Revue d'Anth., p. 243, 1888.
[3] Diction. des Sciences Anthrop., p. 1073.

found in the grave were a few iron nails and traces of wooden boards, so that one of the bodies, at least, must have been enclosed in a wooden coffin. The trepanned skull was that of a man some forty or fifty years of age, and the operation had been performed on the left parietal bone. The perforation is described as of the shape and size of a pigeon's egg, with a bevelled margin, and distinct traces of separation in the cellular tissues of the surrounding bone (Fig. 82). According to Dr Liebrecht, who carefully examined the specimen, there could be no doubt that the operation had been intentionally performed on the living subject for therapeutic purposes.

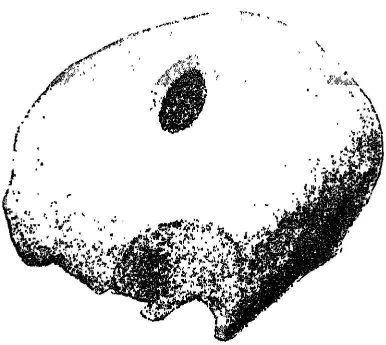

Fig. 82.—*Trepanned skull from Limet, Belgium.* (*After De Nadaillac.*)

M. Pilloy explored a Frankish cemetery in a field near St Quentin, which, in his opinion, had been abandoned as a burial-place about the tenth or eleventh century. One of the graves examined contained a trepanned skull, associated with comparatively modern objects, such as a buckle and an iron knife, articles which he assigned to the sixth

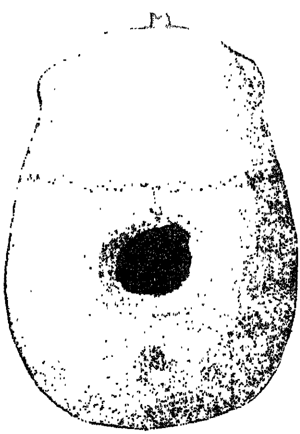

Fig. 83.—*Trepanned skull from a Frankish grave near St Quentin.*

century. The skull was dolichocephalic (Fig. 83), and belonged to a man of middle height, and of the age of fifty-five or sixty-five years. The perforation was near its summit, and presented a highly bevelled margin containing cicatricial deposits of long standing.[1]

M. Borrel, an architect and a distinguished archæologist, while recently excavating cellars at the hospital of Montiers, in Savoy, came upon a series of stone cists or graves, which he judged to be not earlier than the tenth century. One of the graves contained the skull of an adult man, which presented on the right parietal bone a slightly oval perforation about 1½ inch in diameter. The edges of this opening are described as "rugueux, régulièrement amincis, obliques, taillés aux dépens de la table externe en un biseau aigu, tranchant." According to M. Borrel the trepanning was undoubtedly performed before death for therapeutic purposes, and very probably by the method of scraping the bone.

In 1889 M. Ad. de Mortillet described at the Society of Anthropology the results of the exploration of the Allée Couverte de Dampont (Seine-et-Oise). The industrial remains found here were of the ordinary neolithic character, and included the following: Two polished stone hatchets; some scrapers, borers, and flakes of flint; one or two bone pointers, and portions of deer's horn; a conical shell (*Patella*), pierced at the apex with three small holes; some fragments of pottery. Among a quantity of osseous remains were three fragments of human skulls which had been subjected to one

[1] Matériaux, &c., vol. xxi. p. 272.

or other of the forms of trepanning. The first is a case of *trépanation chirurgicale*, and shows a partially cicatrised perforation on the right temple, measuring $1\frac{1}{8}$ inch by $\frac{5}{8}$ of an inch, which, according to M. de Mortillet, had been effected by scraping the bone with a flint instrument. The second specimen is the left side of a skull which had undergone a post-mortem section of an elongated portion of bone $3\frac{1}{2}$ inches long from the temporal region (Fig. 84). The third, reckoned by the

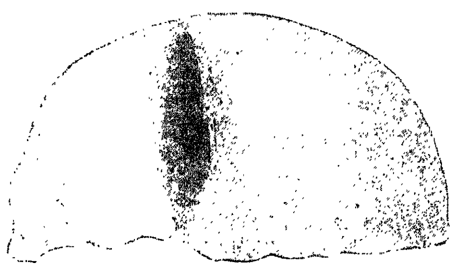

Fig. 84.—*Human skull from the Allée Couverte de Dampont, showing posthumous trepanning.* (*After Ad. de Mortillet.*)

author as a cranial amulet, is an irregularly shaped portion of a skull with a partially cut margin.[1]

In the course of exploring one of the natural caves of Césaréda, known as Casa da Moura, on the right bank of the Tagus, near Lisbon, a large quantity of human bones, representing some one hundred and fifty individuals, was disinterred. It would appear that the neolithic inhabitants had converted the grotto into a cemetery, thus accounting for the large number of bodies it contained. The bones were much decayed, only three or four entire skulls being amongst them,

[1] Bull. de la Soc. d'Anthrop., 1889.

which so far indicated a dolichocephalic race. The upper portion of one of these skulls is of exceptional interest, inasmuch as it furnishes positive evidence of having been partially trepanned (Fig. 85), thus disclosing the initiatory stage of the method adopted in the operation. On the upper part of the left parietal bone there is a deep groove, inclosing a space like a pointed ellipse, 2 inches long by $\frac{3}{4}$ of an inch wide. The upper plate had been cut through by a flint implement, which had been used in a sawing manner — an inference founded on certain markings on the edge of the groove. The intention of the operator was, either to get access to the brain so as to have it cleared out preparatory to preserving the skull as a trophy, or to secure the circumscribed portion of the bone as an amulet; but, for some cause or other, the operation had never been completed. If, however, the operation so far had been performed on the living subject, of which there is no evidence, the patient must have died in the hands of the surgeon. In this case it would show that scraping the bone, as advocated by Broca, was not the only method of trepanning practised among the neolithic people.[1]

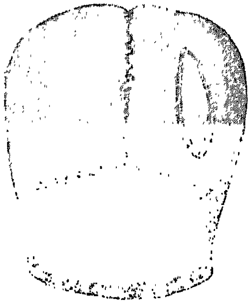

Fig. 85.—*Skull from Casa da Moura (Portugal), showing the commencement of trepanning. (After Cartailhac.)*

At the International Congress of Archæologists at

[1] Cartailhac, Les Âges Préhistoriques de l'Espagne et du Portugal, p. 84. Paris, 1886.

Buda-Pesth (1876), M. Schaaffhausen stated, in the course of the discussion which ensued over Broca's celebrated paper on this subject, that he possessed the skull of a young Roman girl, taken from a grave at Trèves, showing an aperture which must have been intentionally made before death, as the wound had just commenced to cicatrise. On the same authority it was announced that a cranial amulet had lately been found in a tumulus in Thuringia. Also M. Montelius stated that in 1874 he and M. Retzius explored a grave of the late Stone Age at Karleby, in Vester Göthlande, in which they had found a skull containing a round hole, which was pronounced by the latter (M. Retzius) to have been made before death. But the interest attached to the subject was not then known to them, and so the point passed over without further inquiry.

In several of the Swiss lake-dwellings (Gerlafingen, Sutz, Schaffis, and Locras) cranial segments, supposed to have been used as drinking-cups, have from time to time been met with in their *débris*, but only one station —viz., Locras—has yielded an example of a trepanned skull. The case, however, comes under the category of posthumous, as the margin of the perforation is not bevelled but clean cut, and there is no evidence of cicatrisation. The only relics suggestive of the custom of trepanning among the lake-dwellers are a few cranial amulets. One of the so-called *rondelles*, perforated with two small holes, is figured in my recent work on the 'Lake-Dwellings of Europe' (Fig. 185, No. 20).

The German anthropologists had also some cases brought under their notice, one, from the cemetery of

Giebiechenstein in Saxony, being figured in the Proceedings of the Anthropological Society, p. 65, 1879.

The Marquis de Nadaillac informs us that[1] in 1878 Professor Mantegazza presented to the Italian Society of Anthropology the cast of a skull found at Bogdanoff in Russia which bore traces of two operations, one performed during life and the other after death. On the same authority I find it stated that two skulls taken from the dolmens at Roknia in Algeria, and given to the museum of the Société d'Anthropologie, were found by Dr Broca to have been trepanned.[2]

Trepanning practised among various Primitive Races.

Before bringing these records to a close, let me observe that phenomena of a somewhat analogous character have been recorded from regions beyond the confines of the Old-World civilisations of Europe. Indeed, the earliest case of an ancient trepanned skull brought under the notice of European anthropologists is the well-known one from the Inca cemetery in the valley of Yucay, Peru (Fig. 86). It was submitted by Mr Squier to the best surgeons in the United States and Europe, and by all it was regarded as a remarkable evidence of surgical skill in pre-Columbian times. It was exhibited

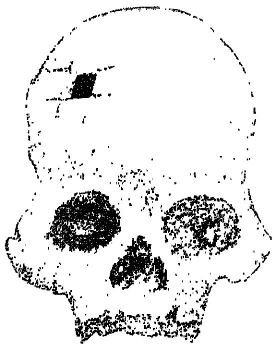

Fig. 86. — *Trepanned skull from an Inca cemetery (Peru). (After Squier.)*

[1] Acad. des Inscrip. et Belles-Lettres, p. 286, 1886. [2] Ibid., p. 289.

and described by Dr Broca, at a meeting of the Anthropological Society of Paris, in 1867, thus preceding the discoveries of Dr Prunières by six or seven years.[1] On the left side of the frontal bone of this skull there was noticed a rounded space, nearly 2 inches in diameter, which presented a whiter appearance than the rest of the surrounding bony surface. In the centre of this space there was a rectangular hole, measuring 15 by 17 millimetres, neatly cut out of the bone by making a linear incision along each of its four sides, the marks of which were still to be seen as deep cuts projecting from the corners of the aperture. Broca came to the conclusion that the white spot indicated the exact part of the bone which had been denuded of its periosteum, preparatory to the operation. The ostitis set up by the excision of the piece of bone did not, therefore, include the portion of skull thus denuded of its periosteum, as it was thereby deprived of its blood-vessels, and consequently retained a bleached appearance. According to Broca and Nelaton the subject of this operation could only have survived from seven to fifteen days.

More recently Mr O. T. Mason describes a posthumous case from the same country; and Dr Fletcher, in his article on prehistoric trepanning,[2] notifies several instances of trepanned skulls from various mounds in North America. But most of these are mere posthumous operations, with round holes bored in the skulls, and they appear to me to have little or no

[1] Bull. de la Soc. d'Anthrop., p. 403, 1867.

[2] Contributions to North American Ethnology, vol. v., 1882.

analogy to the true surgical operation prevalent among the neolithic people of Europe. It may also be noted that cranial amulets have not yet, so far as I know, been recorded from the other side of the Atlantic.

Trepanning, or trephining, as this operation is more frequently called by modern surgeons, has been more or less practised since the earliest historical times. Hippocrates refers to the operation as one of great antiquity, and as being frequently resorted to by the Greek surgeons. From the reports of travellers it would appear that the practice is still prevalent among many primitive people, as, for example, the Ainos, Negritos, Tahitians, &c.[1] The Rev. Samuel Ella, a missionary at Uvea, one of the South Sea Islands, gives a description of the method of performing the operation. A T incision was made on the scalp, and then the bone scraped with a piece of glass till perforation of the skull was completed.[2] According to Baron Larrey, the Kabyles, the descendants of the ancient Berbers, now almost confined to the southern range of the Atlas Mountains, have practised trepanning from the most ancient times, and the practice still finds favour among them. The operation is performed by specially constructed metal instruments, and is resorted to for various therapeutic purposes, such as fracture of the skull, disease of the bones, pains in the head.[3] Baron de Baye states, on the

[1] Nadaillac, *loc. cit.;* Bull. de la Soc. d'Anth., p. 619, 1875.

[2] Medical Times and Gazette, 1874.

[3] Bull. de l'Acad. de Médecine, vol. xxii. p. 87.

authority of a quoted work on Montenegro,[1] that the inhabitants of this region are, or recently were, in the habit of getting themselves trepanned for the most trifling ailments, a simple headache being considered a sufficient reason for sending for the local *rebouteur.* Also that the operation was often repeated on the same person, sometimes to the extent of seven or eight times "sans inconvénient pour leur santé."

From these and other considerations it would appear that such interferences with the cranial wall are not so dangerous to life as we might suppose from the results of the operation of trepanning the skull as practised in modern surgery.[2] In support of this opinion I may here notice an observation made by Dr Prunières, that the shepherds in his neighbourhood were in the habit of trepanning sheep affected with a disease called *tournis.* The custom seems to be widely known and still practised in many pastoral districts. On this subject Mr J. Macdonald, secretary of the Highland and Agricultural Society, kindly sends me the following note :—

The practice you refer to is still in use in Scotland. Many a time I have helped in the operation. It is performed to cure a disease called "sturdy," caused by a species of parasite (*Cœnurus cerebralis*), in cysts or bladders containing fluid, which lodge in the brain. The portion of the skull immediately overlying this cyst or bladder becomes soft, and this soft portion is punctured and the cyst removed. I have seen a portion—nearly a square inch—cut out, and a bladder larger than a

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[1] Le Monténegro, le Pays et les Habitants. Paris, 1844.

[2] The tendency of modern surgery in this country is to perform the operation of trepanning for other than traumatic diseases of the skull, a result which is probably due to the progress made in determining the distribution and localisation of brain function.

thimble removed. When performed in good time, and with skill and care, this operation is often quite successful. It is not so much as formerly resorted to; the majority of farmers now think it better to at once slaughter the affected animal. The cutting of the skull seemed to do little or no harm to the animal; the difficulty lies in the fact that the cysts often lodge in positions which cannot be easily reached.

Method of operating in Stone Age.[1]

According to Broca the operation on the living subject was performed almost exclusively on children, without any distinction as to sex, who, as a rule, survived the operation for many years, and sometimes lived to an advanced age. This opinion he supported by several arguments. Among others he instanced the facility and comparative freedom from fatal consequences with which the operation could be accomplished in early youth, while the bones were yet soft and not completely ossified. To show the force of this argument, Broca experimented on different skulls, using bits of glass instead of flint, and with these he scraped a hole in the skull of a two-year-old child in four

Fig. 87.—*Skull from the dolmen of Cibournios, showing posthumous trepanning and a portion (A B) of an old surgical cicatrix. (After Broca)* (⅓).

[1] For an account of this operation in all ages, see the interesting work of MM. Terrier et Péraire, 'L'Opération du Trépan.' Paris, 1895.

minutes, while a similar result on that of an adult took him fifty minutes. Another ingenious argument was the following: His critical eye one day discovered that a trepanned skull in his laboratory was unsymmetrical (Fig. 87). The sagittal suture was observed to be out of the mesial line, and to be bent towards the trepanned aperture. This deviation was evidently due to the operation, and Broca pointed to this result as conclusively proving that it had been performed while the bones were sufficiently plastic to yield to such a disturbing force. That the great anthropologist was right in the inference which he drew from this particular case I have no wish to gainsay, but as to his main contention, in restricting the period of life to childhood when the operation was exclusively performed, subsequent discoveries have shown that he was in error—a fact sufficiently demonstrated by the selected cases already recorded in these pages.

As to the manner of operating, all suggested or possible methods were rejected by Broca, except that of scraping the bone with a sharp piece of flint till a perforation was effected. This was undoubtedly the most common method adopted, and it is the only one which satisfactorily accounts for the characteristic appearance of the large majority of perforations—the scooped surface, irregularly oval or round shape, and bevelled margin being inexplicable on any other reasonable hypothesis. Since then, however, one or two exceptions have been noted, as those from Lizières and Casa da Moura (Fig. 85), but they are so few and of so undecided a character as to justify the

conclusion that the scraping process had been the rule.

As to the selection of the site of the operation, there was evidently no fixed rule, as the perforation may be found on any part of the head, on the body of a bone, or across a suture. It would appear, however, that the forehead was purposely avoided so as to prevent disfigurement of the face.

I have now laid before my readers a brief epitome of the facts and phenomena which I regard as sufficient evidence of the correctness of my general thesis. For this exposition of them I claim neither exhaustiveness of the materials nor originality in their interpretation. It is quite possible that I have omitted some illustrations which a more careful search of the records would have revealed; while it is still more probable that there are others lying in our various museums which have hitherto escaped observation. But these are immaterial points, as no statistical data could, in the present state of our knowledge, yield a sufficiently comprehensive basis for determining the extent to which the practice of trepanning was carried on by the various races of prehistoric times. Till now Scotland, if not the whole of the British Isles, would have been altogether excluded from the archæological area of its occurrence — a result which would have been due to sheer want of attention to existing materials. The absence of recorded cases in other provinces and districts in Europe may also be similarly accounted for. On the present occasion I am only concerned to prove that the practice did actually

exist in these early times; and with the practical illustration now before us, as well as the numerous instances I have just described on the authority of some of the ablest anthropologists of this century, I think the problem may be accepted as demonstrated. With its acceptance the further phases of this inquiry may be said to rise into a higher sphere than that generally assigned to prehistoric archæology. The simple question, Why or for what purpose was this operation then performed? brings us into direct contact with our present civilisation. Were the motives that guided the hand of the neolithic operator inspired by therapeutic exigencies or by religious sentiments? Was the result of the operation to benefit the individual in this or in a future world?

Dr Broca's Hypothesis as to its Object.

It is in propounding an hypothesis as to the object for which the operation was performed that Dr Broca has supplied the most novel suggestions. He believed that in the main the operation was resorted to for therapeutic purposes, chiefly to relieve mental disorders, as epilepsy, convulsions, lunacy, &c. We now know that many of the convulsions of childhood, such as those due to dentition and other physiological causes of a temporarily disturbing character, disappear in adult life without any specific treatment. But it cannot be supposed that medical science in those days was so far advanced as to distinguish between the varieties of epileptiform diseases. Such

diseases were in all likelihood then considered to be due to some supernatural or demoniacal agency that had taken hold of the individual — a superstition that has found credence in all ages of the world's history, if, indeed, it is yet extinct even among our so-called civilised nations. People looked upon the spasms and contortions of epilepsy as positive evidence that an evil spirit was confined within the skull and struggling for freedom. With such a preconceived notion, or perhaps as an article of a long-cherished faith, what could be more natural than to suppose that by boring a hole in the prison walls the escape of the evil spirit would be facilitated? In support of this theory Dr Broca quotes an author of the seventeenth century who recommended as a remedy against epilepsy the scraping off of a portion of the upper plate of the skull, and sometimes the entire excision of the bone down to the dura mater—a practice which he (Broca) considered to be a survival of the still more ancient custom of trepanning.[1] Indeed, partial removal of the upper plate of the cranial case (Fig. 88) had in several instances been met with concurrently with some of the perforated skulls and

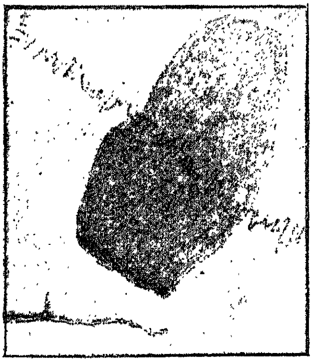


Fig. 88.—*Portion of a skull showing a scraped depression across the right lambdoidal suture* (⅔).

[1] Jehan Taxil, Traité de l'Épilepsie, Maladie vulgairement appelée au Pays de Provence la Gouttete aux Petits Enfants. Lyon, 1603.

amulets—a fact which had not escaped Broca.[1] That it was, however, a distinct and special operation in neolithic times was shortly afterwards confirmed by further discoveries, notably by a case recorded by M. Guégan from the dolmen of Etang-la-Ville.[2] Hence it would appear that both the partial and complete removal of a portion of the cranial wall had been practised in prehistoric times, though the former only survived to the Middle Ages as a remedy against epilepsy. Another old remedy for this disease, and one which might also have a similar origin, was to administer to the patient some particular part of the human skull, such as the *ossa wormiana*, reduced into powder or ashes. That peculiar medicinal properties were traditionally assigned to the bones of the human skull, and that they were used as special remedies for diseases of the head, was further shown by Dr Prunières, who quotes a passage from a work by Nicolas Lemery[3] (1699) to the effect that preference is to be given to "le crâne d'un jeune homme mort de mort violente et qui n'ait pas été inhumé."

Dr Belluci, in the catalogue of his well-known collection of Italian amulets, exhibited at the Paris Exhibition of 1889, describes two made of cranial bones which were found in the possession of old men who were then using them as charms against epilepsy and other nervous diseases.

Dr Prunières, ever since the pathological character

[1] Congrès International, &c., p. 178.
[2] Bull. de la Soc. d'Anth., 1878, p. 198.
[3] Traité Universel de Drogues Simples. Paris, 1699.

of trepanning was recognised, contended that the operation had been occasionally performed for a purely surgical purpose, such as the removal of dead bone; and this opinion he founded on special features of some of the trepanned skulls in his own collection.[1] Broca, however, thought the evidence then insufficient to justify this conclusion. The subsequent researches of Dr Parrot and others have demonstrated that Dr Prunières was right, and the question may now be accepted as settled in the affirmative. But these purely surgical cases are very few in comparison with those which show no pre-existing lesion whatever in the bony tissues. Hence we must conclude that in the majority of cases the primary object of the operation was some mental disorder of an epileptiform character.

Posthumous Operations and Cranial Amulets.

Posthumous operations on the skull can be distinguished from those performed on the living subject by several characteristics. The aperture in the former is generally larger, and its outline more irregular; the surrounding edge is perpendicular, or at a slight angle to the surface of the skull, and presents a series of separate cuts or sawing marks, according to the kind of instrument used in the operation. The manipulation is altogether rougher, and often leaves gashes and scratches on the adjacent bone. The cuts have also a kind of fresh appearance, and never show any cica-

[1] Bull. de la Soc. d'Anth., 1876, p. 243.

tricial deposits. But as the latter characteristic requires the subject to be in life for at least some days after the operation, this distinction is not applicable to those who immediately succumb to its effects. The most remarkable fact in regard to these post-mortem cases is that, almost invariably, there is some part or portion of the edge of the perforation which shows signs of an old cicatrisation. This fact suggests the idea that the special reason for the secondary or post-mortem interference was to be found in the fact that the individual had successfully undergone the surgical operation (Figs. 79 and 87). Here, at last, we have a clue to the motives of these posthumous trepanners, as well as a striking confirmation of the theory which explains the use of the pieces taken away as amulets. That at death the skull of a person successfully trepanned would be held in repute as a prophylactic against all diseases assigned to malign influences is not, after all, such a far-fetched hypothesis. If so, what would be more natural than the belief that an amulet would be more efficacious if it retained a small section of the actually cicatrised margin? That this was a special character in the selection of cranial amulets is unhesitatingly affirmed by Dr Broca. In looking over the specimens figured by him, I find that the retention of a falciform portion of the primary cicatrix is a constant feature in all the irregularly shaped ones (Fig. 89).

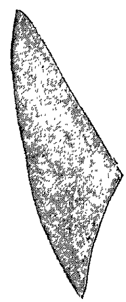


Fig. 89.—*Cranial amulet showing portion of a trepanned cicatrix* (⅔).

But the great veneration associated with a trepanned skull was not, in the opinion of Broca, confined to this world, but also extended to that which is to come. Hence, when the posthumous operation was performed —and this, judging from the number of entire specimens that have been collected, would have been comparatively seldom—care would be taken by the relatives of the deceased that some portion of the cicatrisation would be left. Evidence of the supernatural favours bestowed on the individual during life was not on any account to be totally destroyed, as it was a passport to the world to come, where it ensured to the owner a place of distinction. For similar reasons we can understand why an amulet would be buried along with the body of its owner. This precious relic, or talisman, was to accompany him to his new abode, where, by means of it, he could exercise his magic and beneficent powers in keeping malign influences at bay. Sometimes the friends of the deceased went so far as to put the amulet inside the skull, three examples of which are recorded by Dr Prunières, but for what purpose it is hard to say.[1]

[1] Mr Frank R. Fowke in a thoughtful review of this subject which appeared in 'Nature,' May 25, 1893, writes as follows: "Dr Munro considers it hard to say for what purpose such an insertion should have been made, but,. arguing from his data, the practice does not appear to me difficult of explanation. He has shown that disease was the work of a demon imprisoned in the skull; that this demon was expelled through the trepanned hole; and that its margins were thus sanctified for talismanic purposes. The unclean spirit was gone out of the man, and observation showed that, during the man's earthly existence, he did not return; but what guarantee was there that in the dim unknown region to which the deceased was passing the assaults of the evil one might not be renewed, that he might not return to his house whence he came out, and, with or without other spirits more wicked than himself, enter in and dwell in the swept and garnished abode? Surely, with such a possibility before them,

Baron de Baye describes something analogous to this from the caves of Petit-Morin, where he found several human skulls containing the bones of infants and other objects.[1]

It is not absolutely proved that all cranial amulets were exclusively derived from trepanned skulls, as there are some which show no trace of an old cicatrisation or a falciform margin. These generally assume some regular form, as that of a triangle, an oval, or a circle, and they are sometimes perforated with one or two holes for suspension (Fig. 78). One peculiarity equally common to all classes of amulets is the bevelled shape of their margin, a result which is almost invariably accomplished at the expense of the upper plate of the cranial bone. The range of these cranial amulets, both chronologically and geographically, corresponds very closely with that of the trepanned skulls. Their prevalence in Gaulish cemeteries is attested by M. de Mortillet,[2] Baron de Baye,[3] and other authorities.

Amulets made of human bones other than those of the skull have been rarely met with. One supposed to

it was the duty of pious mourners to offer all the protection that religion could suggest, and to defend the citadel with that potent amulet which recorded the previous discomfiture of the besieger. The post-mortem trepanning may have been such a pious endeavour to carry sacramental benefits beyond the grave, as induced the early Christians to be baptised for the dead, and, if there be truth in the deductions which have been made from the evidence, they point not only to a belief in the supernatural and in the existence of a future state, but also to that pathetic struggle of human love to penetrate the kingdom of death, which has persisted from the death of 'Cain, the first male child, to him that did but yesterday suspire.'"

[1] Arch. Préhistorique, p. 120.

[2] Revue d'Anthropologie, 1876.

[3] *Loc. cit.*, p. 188.

be of this character is recorded from the Dolmen de Vauréal (Seine-et-Oise), and consists of the upper portion of a shoulder-blade in which was inserted a small bronze ring for suspension.[1] The late M. de Quatrefages refers to one he had seen in the collection of Baron de Baye which was made of a long bone, probably a femur.[2]

Additional Discoveries (1897).

The primary object of the above dissertation was to connect the trepanned skull from the island of Bute with analogous discoveries in other parts of Europe. In the selection of illustrative examples the further object of giving a fair idea of the distribution of the custom of trepanning, both in space and time, was steadily kept in view without, however, any strained effort to produce an exhaustive memoir on the subject. In course of this inquiry we have seen that, in addition to the large number of trepanned skulls and cranial amulets disinterred from dolmens and sepulchral caverns in France, instances had been recorded from almost every country in Europe, many of them dating back to the Stone Age people. The general results arrived at showed that trepanning the human skull was practised by all the neolithic people, including both the dolichocephalic and brachycephalic races; that the practice was continued in some parts of Europe down to proto-historic, if not, indeed, medieval times; that it survived till lately among various barbarous

[1] Matériaux, &c., vol. xii. p. 166.
[2] Hommes Fossiles et H. Sauvages, p. 130.

races of the Old and the New worlds; that the primary object of the operation was to relieve mental or bodily ailments; and finally, that friends and others were in the habit of cutting amulets from the skulls of persons so operated on (of course after death), to which great importance was attached. To these general conclusions I have now little to add beyond filling in, here and there, some further details which have come to light.

Dr Verneau, in describing a number of relics taken from the Allée Couverte des Mureaux (Seine-et-Oise),[1] notices among the osseous remains some fragments of trepanned skulls. Also M. Houzé, in an article on "Les Crânes neolithiques des Cavernes d'Hastières,"[2] informs us that the people who owned these sepulchres practised trepanning. More recently Professor Virchow gives a description of a skull found in the cemetery of Gaya, in Moravia (Bronze Age), which had a large portion of the crown artificially removed—a mutilation which he considered to have been post-mortem. Professor Anoutchine announced at the Archæological Congress held at Wilna in 1893 that an amulet, made of a portion of a human skull with a small perforation for suspension, had been found in a neolithic oppidum, in Russia (government of Kostroma)—a discovery which he subsequently published (1895), at Moscow, under the title of "A Cranial Amulet and Trepanning in Russia in Ancient Times."[3]

[1] L'Anthropologie, vol. i. p. 182.
[2] Bull. de la Soc. d'Anth. Bruxelles, 1890.
[3] Centralblatt, vol. i. p. 57.

At a meeting of the Anthropological Society of Berlin, held on January 25, 1896, Herr v. Luschan exhibited a number of skulls from the Island of Teneriffe, three of which had been trepanned. The cicatrices in all three were quite smooth, showing that the individuals had recovered, at least from the effects of the operation. One of the apertures, situated on the right parietal bone, is described as funnel-shaped and occupying an oval space, $36^{mm.}$ by $22^{mm.}$ The second—in the left parietal—differed from the former only in being a little smaller. The third (of which a photographic illustration is given)[1] shows a smooth cup-shaped cavity, about an inch in diameter, sloping gently all round to an opening of about half an inch in diameter. Its site was in the frontal bone, about a finger-breadth above the centre of the left orbital margin. A line of a healed fracture, extending from the edge of the perforation to the margin of the orbit, suggested to Herr v. Luschan that the operation had been performed in consequence of a traumatic injury. But in both the other specimens it must have been undertaken for other reasons.

The author, at the same time, described seven other cases of trepanning on skulls from Teneriffe, which he had observed in various collections in North Germany. Altogether, out of 210 skulls from this island, which he had examined, not fewer than ten had been operated on, all of them probably during lifetime.

But within the wide geographical range to which the custom has been traced the British Isles have hitherto furnished the fewest examples. It is, therefore, with

[1] Zeit. für Eth., 1896, Verhand., p. 63.

pleasure that I have here to announce two unrecorded cases from this area, one in Scotland and the other in England. Both, however, appear, for reasons which will be given in the sequel, to be of later date than the Bute specimen.

One of these (Fig. 90) was exhibited at a meeting of the Society of Antiquaries of Scotland by Professor

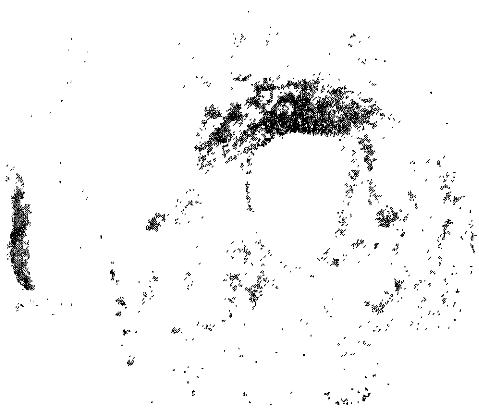


Fig. 90.—*Trepanned skull in F.C. College Museum, Edinburgh.* (*From a photograph.*)

Duns, D.D., on the same evening (14th December 1891) on which I read my paper on Prehistoric Trepanning; and thus it came under my notice. It is an undoubted case of surgical trepanning, but, judging from the more vertical edge of the aperture, I should be disposed to regard the operation as having been performed with a better instrument than flint, as it would appear that a disc of bone, corresponding to the size of the aperture,

had been removed. At any rate the opening has a different appearance from the cup-shaped cavity to be seen on the Bute specimen, which clearly shows (Fig. 75) that the operation had been performed by scraping the bone with a sharp tool, probably made of flint, until perforation had been effected. The inner edge of the latter was also thin and very irregular, owing to the large bevelled margin left after the perforation had been completed. The aperture of that in Professor Duns' possession is situated in the upper and posterior angle of the left parietal bone, about equally distant, some $20^{mm.}$, from the sagittal and lambdoidal sutures. The right edge, as may be seen from the figure, is more bevelled than the left, and the entire margin is smooth and velvety, as if incrusted with a layer of white enamel—a fact which conclusively proves that the individual survived the operation. The opening is irregularly oval in shape and measures $34^{mm.}$ by $25^{mm.}$ as its maxima and minima diameters.

For the following note I am indebted to Professor Duns:—

> Enclosed is the photo of the trepanned skull, of which, however, I have little to say. About thirty years ago it came into my possession as Prehistoric (among the collection of my predecessor, Professor John Fleming), yet without a history of its finding! In outlines, in the condition of the bone, in the shape of the trepanned aperture, and in the resemblance which it bears to a skull I took several years ago out of a very rude half-length stone cist, there is much in favour of this view as to its age.

The English skull is, unfortunately, also without a history; but, independent of the fact that it has two

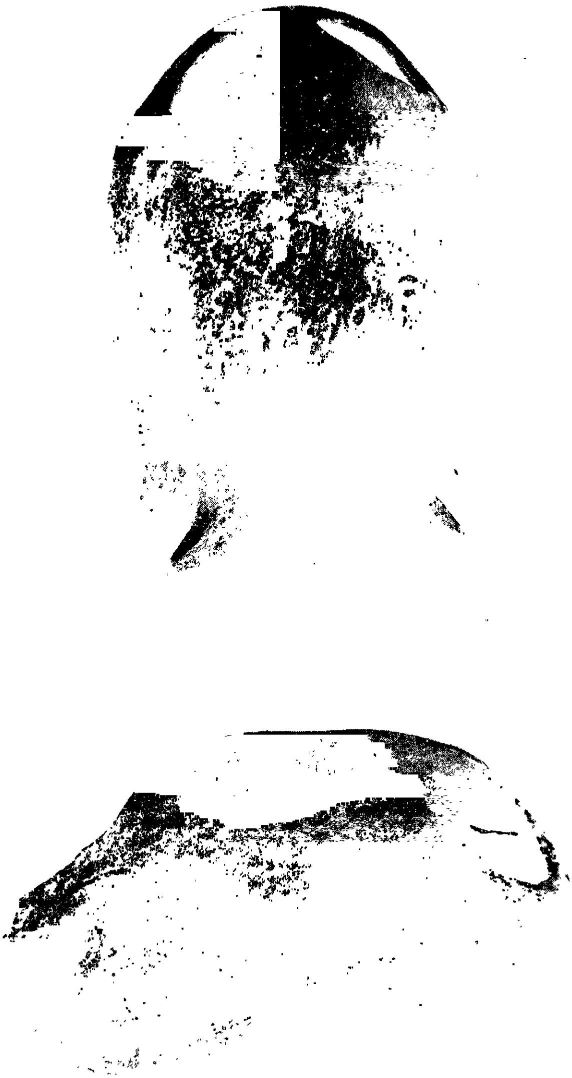


Plate IV.

TREPANNED SKULL FROM EASTRY.—Side and Top Views.

PLATE V.

TREPANNED SKULL FROM EASTRY.—BACK AND FRONT VIEWS.

trepanned apertures on the posterior aspect of the calvaria, it presents so many anatomical peculiarities, or rather abnormalities, that it is well worthy the attention of experts in craniology. As its deformity was probably due to pathological causes, it is interesting to note that the operation had been resorted to as a means of treatment.

It first came under my notice during the meeting of the British Association at Liverpool last autumn. Sauntering into the Public Museum, I observed the skull in one of the side-cases, and, as it appeared to have been trepanned, I asked Emeritus Professor Struthers, whom I accidentally met in the Museum, to come and look at it. We both agreed that anatomically it was a most remarkable-looking skull, and so we sent for Dr Forbes, director of the Museum, who most obligingly opened the case and allowed us to inspect it. That it was an example of double-trepanning there could be no doubt, and being interested in the subject, he kindly gave me permission to publish a notice of it. Of its *provenance* all we could gather is thus stated by Dr Forbes :—

The information we possess about the skull is *very* small. It originally formed part of the Rolfe collection, and all we know about it is that it was found in Eastry churchyard, four or five miles from Sandwich, in Kent. The Rolfe collection was purchased by Mr Mayer, and by him presented, along with the Bryan Faussett and his general collections, to this Museum. For some account of Rolfe, cf. C. Roach Smith's 'Collectanea Antiqua,' vol. v., 1861 (printed for subscribers only). I can trace the trepanned skull no further. There is no mention of it in the frequent references to Rolfe's collection in the 'Collectanea.'

Such being the circumstances, I confine myself to giving four views (Pl. IV. and V.) of this very remarkable skull. Like that in the possession of Dr Duns, its trepanned apertures show clean-cut and slightly rounded edges (but not so much bevelled as the former), the production of which seems to me to have entailed the use of surgical implements of a higher order than were to be had either in the Bronze or Stone Age. The simplest and safest method of operating was by scraping the bone with a flint implement, as was practised by the Neolithic inhabitants of Europe; but neither of these two cases appears to have been so treated. There is, therefore, no warranty, either in the peculiarities of the aperture or in the circumstances in which the skulls have come before us, to assign either of them to the Prehistoric period. Indeed, as regards the English specimen, its association with a churchyard of the present day would hardly carry us beyond early medieval times—thus allying it, chronologically and circumstantially, with the trepanned skulls of Limet, in Belgium, and of Montiers, in Savoy.

The T *Sincipital.*

Before bringing these notes to a close I have a few remarks to make on a new species of cranial mutilation, to which Professor Manouvrier[1] has recently called attention, under the name of the T *Sincipital*. It consists of a cicatrix more or less shallow, but always of the same form, and always occupying the vertex of the

[1] Revue Mensuelle, 1896, p. 57.

Calvaria, or Sinciput. It begins a little behind the curve of the forehead, follows the sagittal suture backwards to the posterior part of the head where it meets the transverse bar of the T. This latter descends symmetrically and almost perpendicularly on each side to a spot behind the parietal eminence (*bosse pariétale*). Fig. 91, which is a reproduction of the illustration accompanying Professor Manouvrier's article, gives a better idea of this curious mutilation than any amount of writing. It represents a skull taken from the dolmen of Conflans-Sainte-Honorine (Seine-et-Oise), after a drawing by M. Ad. de Mortillet.

Professor Manouvrier informs us that of twelve skulls found in the dolmen of "La Justice" at Épône (Seine-et-Oise), three, all of females, were found to have been subjected to this strange mutilation. Of the remaining nine skulls, six were also those of females, but they had not been so treated.

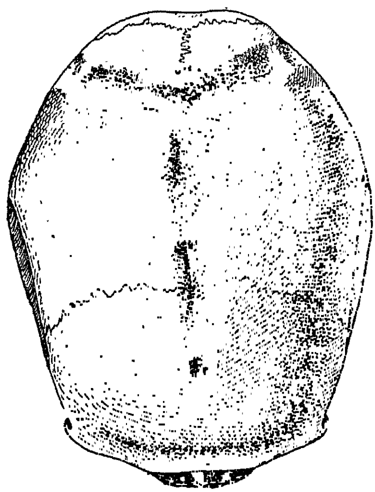


Fig. 91.—*Skull from the dolmen of Conflans-Sainte-Honorine (Seine-et-Oise), showing the T Sincipital. (After Manouvrier.)*

On searching through the extensive series of skulls in the Broca Museum, Manouvrier detected other three skulls, also all of females, marked with the T Sincipital, exactly of the same form and size as on those of Épône. What adds to the interest of the

subject is, that the six skulls thus branded came from dolmens situated in a limited area around the junction of the river Oise with the Seine.

The skull which presented the deepest and most pronounced cicatrix was that of an elderly woman from the dolmen of Feigneaux (Oise); while the shallowest and least clearly defined cicatrix was on that of a young woman from the dolmen of Vauréal (Seine-et-Oise). From this fact Professor Manouvrier suggests that the mutilation in question was a consequence of some severe ordeal, probably a religious rite, faithfully carried out for many years. As a possible explanation for its situation, he points out that the lines of direction of the T Sincipital follow those most naturally adopted in parting the hair of the head. But the phenomenon awaits further elucidation.

CHAPTER VI.

OTTER AND BEAVER TRAPS—A STRANGE CHAPTER IN COMPARATIVE ARCHÆOLOGY.

Part I. Discoveries prior to 1891.—Discovery of strange Wooden Machines in Laibach Moor—Analogous objects found in North Germany—Origin of the Beaver-trap Theory—Discovery of similar objects at Fontega—"Antique Wooden Implement" from Coolnaman, Ireland—A Welsh "Musical Instrument"—Classificatory review of these objects—A second specimen found in Ireland.

Part II. Subsequent Discoveries.—Sig. Paolo Lioy on the "Misteriose Barchette"—Further examples in North Germany—Recent Discoveries in Laibach Moor—Beaver-trap Theory controverted—The Larkhill hoard in Ireland—General Remarks—Literature.

Part I. Discoveries prior to 1891.

My attention was first directed in the summer of 1888 to the very remarkable and puzzling objects which I am now about to describe. In laying the facts before you, I find it preferable to deviate from the chronological order of their discovery, which in ordinary circumstances would have been the better method, and to follow that by which the details of the respective objects came to my knowledge. One reason for selecting this method is that this is the first time all the

objects in question have been correlated and shown to be individual members of one specific group, whatever their purpose may have been. Also, the order of my narrative closely coincides with the steps of the generalising process which led to this deduction, and consequently it forms a special feature of my communication.

Discovery of strange Wooden Machines in Laibach Moor.

In the vicinity of Laibach, the capital of Carniola, there is an extensive peat-moor, known to have been formerly a lake, and in which, in modern times, the remains of several pile-dwellings have been discovered and investigated. Among a large and varied assortment of relics, chiefly of the Stone and early Bronze Ages, disinterred from these habitations, I saw, in 1888, two wooden objects, the meaning or purpose of which had, for several years, completely baffled the late Dr Karl Deschmann, Curator of the Landesmuseum there, and other experienced archæologists who had seen them. A drawing of the more complete and better preserved is here given (Fig. 92), from which its main structural features will be readily understood. It consists of a flat solid piece of oak, shaped somewhat like a boat, and measuring 32 inches long, 12 broad in its widest part, and 4 thick. It is perforated in the centre by a rectangular opening 9 inches in length and 5 in breadth, into which are fitted two movable valves, each revolving on its posterior margin

as an axis lying in a groove, and having a projecting pivot at each end which fits into a corresponding cavity in the framework. These valves are freely movable when pushed upwards, but this motion is arrested, just a little short of the perpendicular, by the slant-

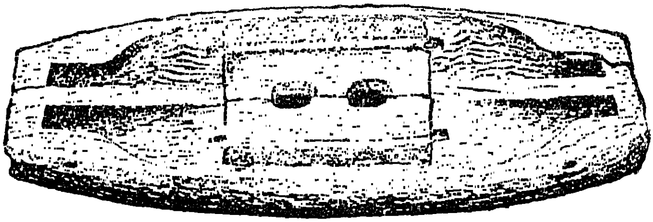


Fig. 92.—*Wooden Machine from Laibach*, 32 *inches long*.

ing shape of their margins, so that, when left free or unsupported, they always fall inwards—never backwards—and so close the aperture. In this condition —*i.e.*, closed—the valves are at rest, and are prevented from falling downwards by about an inch of chamfering at each end of the aperture. The two terminal and symmetrical spaces which occupy the rest of the surface of the machine are each occupied by two elongated hollows, which, beginning near the margin of the central opening, gradually become deeper, till they end abruptly within a few inches of the extremities. The medial septum, towards its distal end, and the lateral margins formed by these hollows, are perforated transversely with round holes in line, so that a stick could be passed from side to side, leaving, of course, the portions crossing the hollows free. Along with the oak framework were found a few bits of round sticks, which Herr Schulz, Dr Deschmann's assistant,

believed to be the decayed remains of some kind of mechanism for working the machine. The other object was in a fragmentary condition owing to decay; but, so far as could be judged from what remained, it was both in structure and dimensions identical with the former.

As these singular objects were found not exactly on, but at a little distance from, the site of a lake-dwelling, they were not at first included in the general collection of lake-dwelling remains—though, being found in the same archæological stratum, there was no valid reason for their exclusion — and so they were laid aside for several years as objects of a *sui generis* character. It was not till some German anthropologists, who happened to visit the Museum, had recognised their similarity to a series of objects found in North Germany that any theory as to their function was formulated.

Analogous Objects found in North Germany.

The first of the analogous objects thus referred to was figured and described by Dr Hildebrandt, of Tribsees, Neuvorpommern, in the 'Zeitschrift für Ethnologie' for 1873.[1] A mere glance at the accompanying sketch (Fig. 93) shows how closely it resembles the Laibach machines both as regards form and structure. It has a central aperture closed by two valves, two elongated hollows, and a lateral perforation at each end. Its dimensions are stated to be 29½ inches long and 6 inches broad at the extremities. It differs from the one figured from

[1] Verhand., vol. v. p. 119.

Laibach in not having any semi-lunar cuts in the free edges of the valves, which, as will be seen from the drawing (Fig. 92), are so arranged in the latter that they form, when the valves are brought together, two

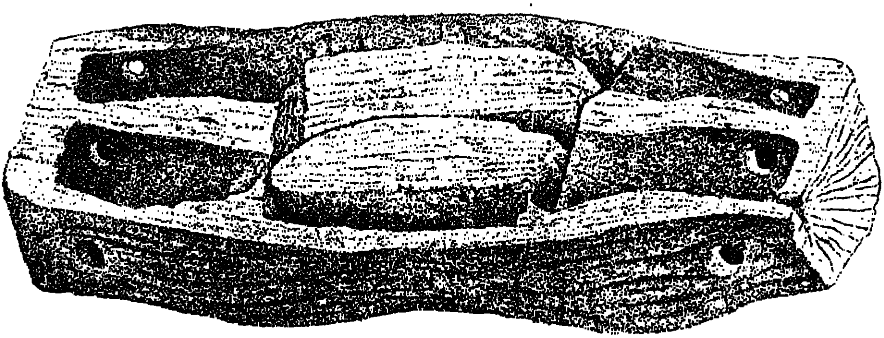


Fig. 93.—*Wooden Machine from North Germany. Length,* 29½ *inches.*

oval perforations. It had been found in a peat-bog at a depth of 5 or 6 feet, and shortly afterwards sent to Dr Hausmann for the Archæological Museum at Greifswald. As to its use, it was conjectured to be part of an apparatus for catching or retaining fish (*Fischbehältniss*) by means of a net attached through the lateral holes.

In the following year, Professor F. Merkel, of Rostock, in reply to Dr Hildebrandt's communication, figured and described in the same journal[1] another object of the same kind which had lately been found, at a depth of 6 or 7 feet, in the Moor of Samow, near Gnoien, and was then preserved in the Museum of Rostock. Its dimensions are stated to be 3 feet in length, 11 inches in greatest breadth, and 3¾ to 5 inches in thickness—the thickest portions being near the extremities. The re-

[1] Vol. vi. p. 180.

semblance of this one to the Laibach machine is still more striking than that of Tribsees, from which it differs only by having three semi-lunar cuts, instead of two, in the valvular edges (Fig. 94).

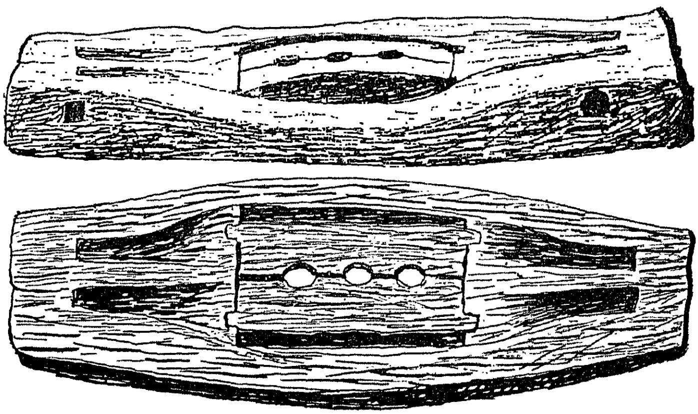


Fig. 94.—*Wooden Machine, 3 feet long, from North Germany.*

Associated and apparently connected with this machine were about half-a-dozen pieces of round stick some 1½ inch thick, a small portion of wrought wood, and a shovel-shaped piece of horn said to be that of the Elk (*Cervus alces*). According to the opinion of Mr Boldt, its discoverer, it was a trap for catching otters.

A few years later Mr Friedel announced[1] that a third example of the so-called otter-traps had just been sent to the Märkisches Museum. It had been disinterred from a peat-moor at Friedrichsbruch, near Flatow, in the province of West Prussia. This object is not figured, nor described beyond the statement that it strongly resembled those already noticed from Tribsees and

[1] Verhand., vol. ix. p. 162.

Rostock. Major von Heister, a sportsman, is reported to have pronounced it also an otter-trap. He considered that elastic rods extended from the end hollows to the valves, on which they were made to press hard, especially when the latter were open. In setting the trap, the valves were kept asunder by a bit of stick, to which the bait was attached, and on its removal—a contingency which would occur if an otter grabbed at the bait—the valves would immediately close by the pressure of the elastic rods, and so the animal became trapped. Although Mr Friedel does not specify the depth at which this supposed trap had been buried, I am enabled to supply this information from a small publication which has just come to hand from Danzig.[1] In this brochure there is an article on prehistoric fishing, by Dr Conwentz, Curator of the Danzig Museum, and among the fishing gear therein described he includes this otter-trap. According to him, the trap had been disinterred from a depth of 7 feet 10 inches. Dr Conwentz also suggests a *modus operandi* somewhat similar to that of Major von Heister, and adds that when the otter inserted its head into the space left free by the open valves, they—*i.e.*, the valves—closed over its neck, and so the animal became ultimately either drowned or strangled.

Origin of Beaver-trap Theory.

Profiting by the published descriptions of the analogous objects thus brought under his notice, Dr

[1] Festgabe für die Theilnehmer des III. Deutschen Fischereitages zu Danzig, 1890.

Deschmann at once considered how the trap theory would apply to those in his possession. Looking at the vast amount of osseous remains collected from the *débris* of the lake-dwellings — a characteristic feature of which was the great preponderance of those of wild animals—he ascertained that while the bones of the beaver were unusually numerous, representing at least 140 individuals, there were actually none of the otter. Consequently Dr Deschmann came to the conclusion that the hitherto unexplained machines from Laibach Moor were the very traps with which the lake-dwellers hunted and captured so many beavers, which, it was evident, had formed no inconsiderable portion of the dietary of this prehistoric colony.

Such was the substance of the information I received from the authorities of the Landesmuseum at Laibach when I last visited that most excellently conducted institution. By this time the *Biberfalle* had been assigned to a prominent position among the rarer objects from the lake-dwellings, and the whole story seemed to me so curious and interesting that I thought it worthy of a place in my Rhind Lectures, which were delivered in the following October (1888).

Discovery of similar objects at Fontega.

So the matter stood till January 1890, when my attention was re-directed to the matter in the following manner: Just while the proofs of my work on 'The Lake-Dwellings of Europe,' containing the report of the so-called otter and beaver traps, were lying before me,

I received from Dr Luigi Meschinelli, of the Geological Museum of the Royal University of Naples, a copy of an article by him entitled "Studio sugli Avanzi Preistorici della Valle di Fontega." The objects described in this memoir were found in the course of excavating peat in a small valley opening into Lake Fimon, the site of a well-known lake-dwelling in the vicinity of Vicenza. Among a quantity of the industrial remains of man, consisting of fragments of pottery, various implements of stone and flint, a bronze celt and a Roman coin of the time of the Emperor Hadrian, were three curious-looking and novel objects of wood shaped like a canoe in miniature. One of these objects—the best preserved though not the largest—was carefully described and figured (Fig. 95). On examining the memoir so opportunely brought under my notice, it seemed to me that we had here to deal with three more of the so-called traps which I have already described as having been found in Laibach Moor and various places in North Germany. The example figured was constructed out of a solid piece of oak, measuring 28 inches in length, 6¾ in breath, and 2¾ in thickness. The opening in the centre was fitted with two valves (here represented as detached), and measured 6½ by 3½ inches, this being the actual size of the aperture when the valves were in position and open. On the off side of the drawing there is seen a deep groove, in which the corresponding valve revolved; also at each end of the aperture the transverse chamfers, which supported the valves when closed, and prevented them from falling through. On the under surface of the machine the

sides of the central aperture are described as not being cut perpendicularly, but slanting outwards so as to assume a considerably larger size—viz., 11 inches by

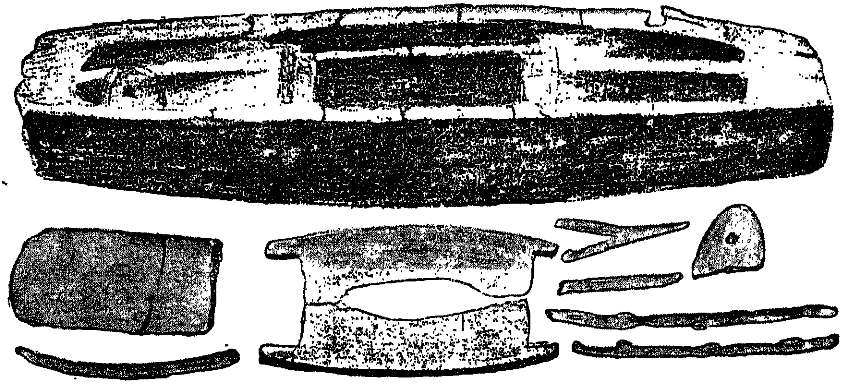


Fig. 95.—*Wooden Machine from Fontega, 28 inches long, with detached valves, and some worked sticks found along with it.*

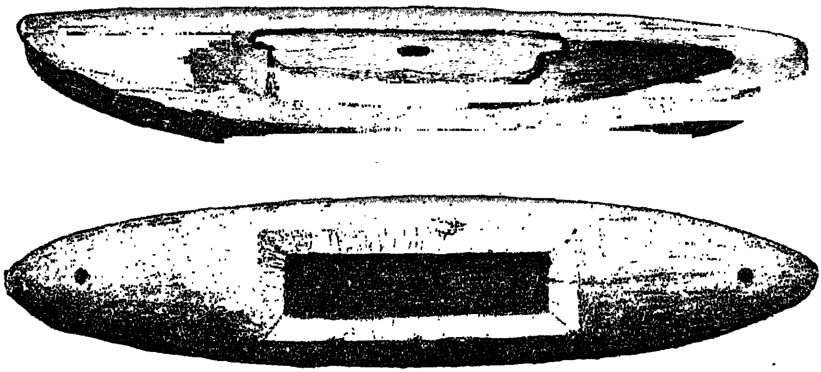


Fig. 96.—*Antique Wooden Implement from Ireland, showing upper and under surfaces. Length, 3 feet 5 inches.*

5½ inches. In addition to the elongated hollows and the transverse holes near their distal ends, there are four other small perforations noticed, one opposite each

of the valvular pivots, into which pins were inserted, evidently for the purpose of preventing the displacement of the valves. In one of the elongated hollows, and in a line with the transverse hole, there was found

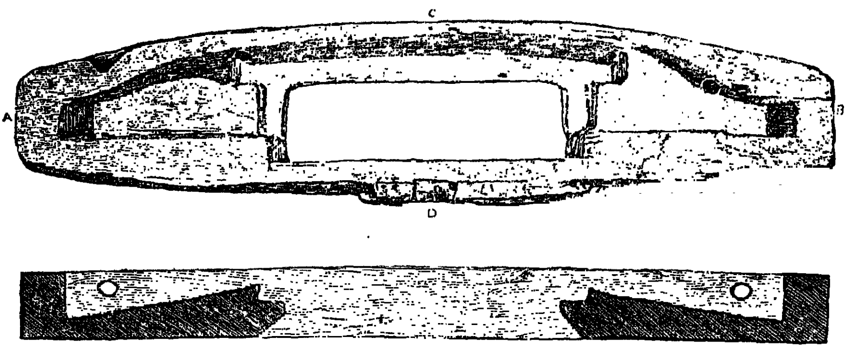


Fig. 97.—*Wooden Implement from Wales, showing upper surface and section through A B. Length, 30 inches.*

a small semi-lunar piece of wood containing a perforation corresponding to that in the framework. It may also be observed that along the free edges of the valves, which did not come into actual contact, there were some holes, three on one side and four on the other, into which small wooden projections appear to have been inserted, thus forming a kind of lattice-work when the valves were closed. Associated with this machine, as seen in the illustration, were several worked portions of sticks supposed to have been the *débris* of some kind of mechanism.

The other two found at Fontega were, according to Dr Meschinelli, precisely similar, so that in all essential particulars they agree with those previously described.

In attempting to assign any utilitarian purpose to these novel objects found at Fontega, Dr Meschinelli (who was then unaware of the existence of similar objects elsewhere) was evidently much puzzled, but ultimately suggested, though somewhat hesitatingly, that they were models of prehistoric boats.

After the careful perusal of this paper I wrote the author a long letter describing what I had heard and seen of analogous objects in other localities in Europe —in fact, I detached from my proofs the portion bearing on the subject, and enclosed it, along with a drawing of the Laibach *beaver-trap*, in my letter. The result of this was the appearance of a second memoir by Dr Meschinelli,[1] in which he reproduces all the facts and illustrations of these perplexing machines so far as then known. He then criticises and rejects all the previous theories and explanations suggested as to their function, as inapplicable at least to those from Fontega, and comes to the conclusion that if the latter were traps at all, they were used for catching water-fowl, which, in prehistoric times, he considered, would have been very abundant in the vicinity of Lake Fimon. This opinion he partly based on the difference of structure in the valves of the Fontega machines, which, as I have already described, had at their free margins a kind of lattice-work or grating (*una specie di graticcio*).

[1] Su alcuni strumenti di legno provenienti da varie abitazioni lacustri di Europa.

"Antique Wooden Implement" from Coolnaman.

But Dr Meschinelli's valuable contributions do not by any means exhaust the interest and curiosity of the subject. Shortly after the receipt of his first memoir I happened to be turning over the leaves of a volume of the 'Ulster Journal of Archæology,' for the purpose of verifying some references, when I came across a plate illustrating a curious-looking object described as "an antique wooden implement," and said to have been extracted from a bog in the townland of Coolnaman, parish of Aghadowey, County Derry, Ireland. Fortunately the editor of the journal, to whom the object had been forwarded, recognised its archæological value, and published a careful description of it, together with three illustrations showing its appearance in different positions, from which I quote the following extract:—

It was discovered embedded in a solid bank of turf, at a depth of 4 feet from the surface, the bog extending to a great depth underneath. No other article was found near it. It is entirely of wood, and measures as follows: Extreme length, 3 feet 5 inches; breadth across the centre, 7½ inches; depth, 2½ inches; lid, 14 inches long and 3½ inches broad; under hole, 12¾ inches long and 3½ inches broad. The upper edges have evidently been higher on all sides when perfect—probably on a level with the lid or small door, or even extending still higher, so as to form a kind of trough. The lid is now somewhat narrower than the opening which it is intended to close, but, no doubt, was made to fit accurately when in use. It moves up and down on a hinge formed by two projections which lie in corresponding hollows, and seems to have been opened and shut by means of a handle inserted into a hole in its centre. These hinges have, no doubt, been kept in their place by some part of

the wood above them which is now lost. From each end of the lid, and on a level with its upper surface, there runs a hollow groove, sloping regularly downwards to the end of the implement, and terminating in a hole which perforates the bottom, seemingly for the discharge of a liquid. Towards each end are two lateral holes placed opposite to each other, one in each lip of the groove, apparently to receive a rope passed through them to serve as a handle for removing the article from place to place. The under side of the implement is flat, having in its centre an oblong hole (the bottom opening of the cavity covered by the lid), which has all its four edges sloped or bevelled. . . . Coolnaman, which gives name to the townland, is a considerable hill, entirely cultivated, but surrounded at its base by a bog of unknown depth, which evidently occupies the site of an ancient lake. On the side of the hill where the implement was discovered the turf has become quite solidified, and forms a dense black mass up to the surface.[1]

It will be at once seen from a glance at Fig. 96, which shows both the upper and under surfaces of this object, that it belongs to the same category as its Continental analogues, and differs from them only in having one valve and a single terminal hollow at each end instead of two. In addition to the lateral holes, which are common to all, there is in the former a small perforation passing from the deepest part of the terminal hollows to the under side of the machine. Mark, also, that the outward bevelling surrounding the central aperture on the under surface is a feature common to it and the Fontega examples.

Neither the editor nor any of the antiquaries who had examined the "antique implement" from Coolnaman at that time had ever seen anything of the kind before. One thought it was a fish-trap intended to

[1] Ulster Journal of Arch., vol. vii. p. 165.

be placed in a stream; another that it was a kind of pump; a third that it was a machine for making peats; and a fourth that it was a cheese-press.[1]

A Welsh "Musical Instrument."

Such was the state of my acquaintance with these researches at the time the final proofs of my work on 'The Lake-Dwellings of Europe' left my hands, and so I took the opportunity of supplementing my original remarks with the additional facts above recorded. A few days after its publication I happened to be in London, where I met Mr J. Romilly Allen, who informed me that, while turning over the leaves of my book, he became much interested in the curious machines which I had figured as otter and beaver traps, because they brought to his recollection that a somewhat similar object had been found in Wales, of which hitherto no rational explanation had been offered. On learning that it had been figured and described in the 'Archæologia Cambrensis,' I went directly to the British Museum Library, where I hunted up the volume containing the details of the discovery, and soon satisfied myself that it was indeed another example of the same mysterious class of objects. Its identity with the "antique wooden implement" from Coolnaman had already been pointed out by Mr E. L. Barnwell, and it now only remains for me to show its relationship to those on the Continent.

From Mr Barnwell's description of the object in

[1] Ulster Journal of Arch., vol. vii. p. 289.

question, the following extracts will sufficiently explain the circumstances which brought it to light :—

It was discovered in August last, on a mountain, and was secured by Mr J. M. Davies, the hospitable entertainer of the members of the excursion on August 20, 1878. It had, however, been dug up, about three years before, on the farm of Nant-y-rast, in the parish of Caio, by the tenant digging for peat, who threw it aside on the ground at the edge of the bog, where Mr Davies found it. That gentleman has made inquiries of carpenters and others in the district as to its nature; but all that he seems to have elicited was that it was a musical instrument of some kind or other. It is curious that Professor Westwood, when he saw it in the local museum, whither it had been subsequently transferred, at once pronounced it a musical instrument, although he had not heard at that time what local tradition had called it. Other suggestions were that it was part of a yoke or a breast plough.[1]

About six months later the same writer recurs to "the supposed musical instrument," and thus introduces a second notice of it :—

After the notice of this curious article had been printed in a former number, it was ascertained that a similar one had been described in vol. vii. of the 'Ulster Journal.' This discovery makes more than doubtful the conclusion that the article was in any way connected with music.[2]

Mr Barnwell then goes on to show that it was a machine for making peat-bricks—a purpose which, it will be remembered, had been already suggested as the probable function of the Irish example: but into the details and arguments by which this opinion was supported I need not here enter.[3]

[1] Arch. Camb., vol. x., 4th ser., p. 4. [2] Ibid., p. 188.

[3] This object is still preserved in the Library of St David's College,

Classificatory Review of these Various Objects.

Reverting now for a moment to the chronological order of these various discoveries—a point, however, which is of little consequence, as they were quite independent of each other—we see that Ireland takes the lead as early as 1859. Next comes the German group, three in number, which became known through the 'Proceedings of the German Anthropological Society' for 1873, 1874, and 1877. The lake-dwelling excavations which were the means of bringing to light the two Laibach ones, were conducted intermittently from 1875 to 1877—a period which almost coincides with that during which the so-called Welsh harp lay weathering on the moor of Froodvale, after the peat-cutter had tossed it aside as useless rubbish, till rescued by Mr Davies in 1878.[1] Dr Meschinelli's first description of

Lampeter, where, quite recently, I had an opportunity of inspecting it. It is made of a solid piece of oak, with the following dimensions—viz., 2 feet 6 inches long, 7 inches wide at the middle, tapering to 4 at each extremity, and 2¾ inches thick. The central aperture is 11 inches long and 3¼ inches wide, and along its margin at each end there is a chamfer an inch broad, and of the same depth as the lateral groove in which the valve rotated. The total length of this groove is 14½ inches, hence the valvular hinge must have had a considerable projection at each end of its axis. The transverse perforations near the extremity of the machine, as shown in Fig. 97, measure ¾ of an inch in diameter. The valve appears to have been lost, but there can be no doubt that it formerly existed, and Mr Barnwell gives a second illustration showing the restored valve and the pins for keeping it in position. The under margin of the central opening is bevelled in the same way as the Irish and Fontega examples. This implement does not, however, like the Irish one, contain an upright perforation in each of the terminal hollows, but in this negative aspect it agrees with all the Continental types.—January 1891.

[1] The Laibach specimens were for the first time sent to the Landesmuseum in 1880, but they were found several years before this date—one,

the three examples from Fontega was published in 1889, and in March of the following year the same author discussed their relation to analogous remains in Europe in the 'Proceedings of the Royal Academy of Sciences' of Naples. In 'The Lake-Dwellings of Europe' the field of these researches has been extended so as to include Ireland, and to this extension I now add Wales. We have thus to deal with no less than ten wooden implements or machines, all made of oak, and so ingeniously constructed as to leave no doubt that they were intended for some specific purpose. What this purpose was is a problem which is still *sub judice*, and on which there is now an opportunity of trying your skill, as the solutions that have been hitherto proffered disclose a considerable divergence of opinion.

Looking at these objects as a whole, we see that they can be readily arranged into two classes, according as they have one or two valves; and it is remarkable, or at least suggestive, that the geographical area of the former is confined to the British Isles. I do not think, however, the differential character of this classification is of much consequence. The apparent complexity of the bivalvular machines is simply due to a reduplication of the structural elements of the univalvular ones. Each valve is characterised by a series of appurtenances so ingeniously arranged as to make it highly probable that their combination, whether in the simple or compound form, was the product of one original or central invention. Some of the minor,

that here figured, having been in existence as early as 1866 (Argo, 1894, p. 155).

and apparently non-essential, details would also seem to strengthen this opinion, as, for example, the outward bevelling on the under margin of the central aperture, which is common to those from Italy, Wales, and Ireland. The examples from the two former countries also agree in having transverse pins over the pivots of the valves to keep them in position. The technical skill displayed in the construction of both classes is, however, precisely the same, though it may be that the bivalvular was a later and more effective instrument—a sort of advanced evolutionary stage of the other and simpler form.

To find so many of these unique machines in such widely separated districts as Ireland, Wales, North Germany, Laibach, and Italy, must be a matter of interest to archæologists; and no one can positively assert that a correct explanation of their function is to be found in any of the numerous suggestions hitherto offered on this point. I may, however, direct attention to one fact which helps the solution of this problem—viz., that the examples in Italy, Laibach, and Ireland were all found in peat-bogs that are described as having been formerly lakes. Perhaps this is true as regards the others, but the point is not referred to in the short notices of them which have been published. If these machines were really used as traps—an opinion which seems to me the most probable—they could only be made to operate in water where the animal could insert its head from below, and among amphibious animals the *otter* and *beaver* are the only ones to which all the conditions involved in the trap-theory

would apply. Prof. Sir W. Flower, F.R.S., who presided at the sectional meeting of the British Association for the Advancement of Science, held at Leeds, where I shortly discussed this subject, pointed out that they could not be traps for both the otter and beaver, as a different bait would be required. I do not think there is much force in this objection, as the change of bait would be a simple matter. Nor is there, in my opinion, any difficulty about the variation of size of the aperture, as the head of either animal could be inserted into them all. The association of the Laibach machines with the remains of the fauna of the lake-dwellings, in which the beaver was so largely represented, is confirmative, or at least strongly suggestive, of the correctness of Dr Deschmann's opinion that they were beaver-traps. Although this animal is now all but extinct in Europe, there is undoubted evidence that, in prehistoric times, it was not an uncommon inhabitant of this quarter of the globe. Its bones are among the osseous remains collected by Mr Boynton in the recently investigated lake-dwellings in Holderness; and there is historical evidence to prove that the animal was living in Wales and Scotland as late as the middle of the twelfth century.[1] I am not aware that its remains have ever been found in Ireland; nor are they included among the osseous *débris* collected now or previously in Lake Fimon. So far, therefore, there is no presumptive evidence that the machines found in these localities were beaver-traps. That, however, the beaver frequented the Po

[1] Giraldus Cambrensis Itiner. Kambriæ, cap. III.

Valley, we have positive evidence in the discovery of its bones in several localities — as, for example, the *terremare* of Castellaccio and Cogozzo.[1] They have also been frequently met with among the remains of the lake-dwellings of Switzerland and North Germany.[2]

A Second Specimen found in Ireland.

After the foregoing notice was in print I received a communication from the Rev. Canon Grainger, D.D., Broughshane, Ireland, in which he announced that there was in his collection an object very similar to

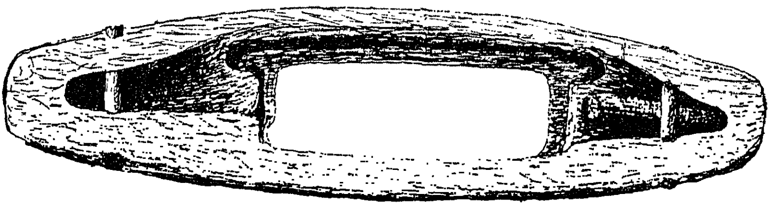


Fig. 98.—*Wooden Machine from Clonetrace, Ireland.*

the so-called otter and beaver traps, and he invited me to come and inspect it. This I did on the 1st May, and it is through his extreme kindness and courtesy on that occasion that I am now enabled to supplement my previous remarks by a short description of the object in question. From a glance at the accompanying sketch (Fig. 98) it will be at once seen how strikingly it agrees in all the essential features of structure with the two examples already found within the British Isles (Figs. 96 and 97). This specimen, like all others

[1] Lake-Dwellings of Europe, pp. 182 and 274. [2] Ibid., p. 586.

of its kind hitherto known, is made of oak, and bears evidence of having been constructed with special regard to strength and solidity. It is 2 feet 7 inches long, 8 inches wide in the middle, tapering to 4 at both ends, and 3 inches thick. The central aperture has a clear opening of 11¼ inches long by 4 inches wide, and at each end there is a rectangular cut, about an inch in breadth and of the same depth as the groove in which the valvular hinge rotated. On its under side the aperture is slightly bevelled outwards, similar to the "antique wooden implement" from Coolnaman (Fig. 96). The transverse bars, which, as seen in the sketch, cross the terminal hollows, are still *in situ*, and underneath one of them there lay a broken portion of a prepared stick, which also appeared to be in its natural position, and to have been made to move when in use backwards and forwards—an inference which I base on the fact that the under side of the bar is worn nearly half through. As this was the case also with the other transverse bar at the opposite end, a further deduction —viz., that the fragmentary stick was part of an elastic bow which extended from the extreme ends of the hollows, passing over the valve but beneath the transverse bars—became inevitable. As a consequence of this simple mechanism the forcible opening of the valve would bend the bow upwards and backwards, and so cause its ends to slip nearer the centre, thus accounting for the friction marks on the under side of the bars. Moreover, as the downward pressure of the valve would be in proportion to the strength and elasticity of the bow, it would follow that if the counteracting force

which retained the valve open (probably a bit of stick to which the bait would be attached) were suddenly removed, the latter would close with a bang, and so jam the intercepted neck of the animal against the edge of the aperture.

On closer inspection of this trap I noticed several other points of minor detail, which might be adduced as evidence that this was its real *modus operandi.* Thus the position of the friction marks on the under side of the transverse bars is not actually in the medial line, but a little nearer the hinge side of the valve, while both the corresponding margins of the terminal hollows curve considerably outwards and show a slight groove, also with friction marks, into which the edge of the bow appeared to fit exactly. The body of the bow, as shown by its section, was of an oval shape with a greater flattening on its under side, and, judging from the fragment still extant, it tapered slightly towards the ends, and each extremity formed a smooth blunt point. The diameter of the transverse bars is about three-quarters of an inch, and underneath each of them there is a clear space of 1½ inch in depth. I may also observe that there is a free interval between them and the terminal ends of the hollows—a fact which is equally applicable to all the machines—so as to allow of the to-and-fro action of the bow necessitated by the opening and shutting of the valve.

Unfortunately, the previous history of this trap, so far as known, throws no additional light on the problem of its use nor on the time when it was made. It was procured some five years ago by Dr Grainger from a local

pedlar, who thought it was an otter for fishing. According to his statement, it had been found on a neighbouring farm, but neither the circumstances of the discovery nor how he came into possession of it have transpired. It is curious how the word "otter" was associated with it, as it has no resemblance whatever to the well-known implement of this name formerly used by anglers in loch-fishing. Is it possible, or probable, that the pedlar received the machine as a real *otter-trap*, which became transformed in his mind, by a mere process of association of ideas, into the better known angler's otter?[1]

In the above notice of these curious implements, now numbering eleven, I have restricted my remarks to a brief statement of the main facts in regard to their discovery and structure, as disclosed by archæological research. But the field of inquiry might with advantage be considerably enlarged, and I would solicit information from at least two other sources, which are sufficiently defined in the following questions: (1) Have we any historical or traditional evidence that our prehistoric forefathers were in the habit of using traps to catch such animals as the otter and beaver? (2) Have sportsmen nothing to say on the subject?—by what means are these animals hunted by modern trappers?

[1] The Rev. G. R. Buick states that the pedlar—Michael M'Keever—secured the trap from the farmer of Clonetrace, who had discovered it a short time before when cutting turf in a bog close by (Journal R.S.A. of Ireland, vol. xx. p. 536).

Part II. Subsequent Discoveries (1897).

Since the remarks comprised in Part I. were written, some five years ago, no further discovery of any importance came to my knowledge till the autumn of 1896, when (October 6) I received a note from Dr W. Fraser of Dublin containing the following announcement: "I heard to-day of the discovery of *nine* of your otter or pike traps in a bog near Ballyshannon. They are made of oak, with, what the writer describes as, 'springs of ash for closing the aperture.'" Before, however, proceeding to give an account of this "find," it will be advisable to gather up the substance of some subsidiary researches which have been made on the Continent with the object of dispelling the mystery which still hangs over those objects—for it is unnecessary to say that implements so novel in structure, and so widely distributed, have excited a lively interest among European archæologists.

Sig. Paolo Lioy on the "Misteriose Barchette."

In 1895 I received from Sig. Paolo Lioy[1] of Vicenza a copy of an article by him entitled "Le Misteriose Barchette della Fontega (Fimon)," in which, after a sketchy review of the previously recorded discoveries

[1] Sig. Lioy is well known among archæologists as the investigator of the lake-dwellings at Fimon, of which he has given an excellent and highly illustrated report under the title "Abitazioni lacustri di Fimon" (Memorie dell' Ist. Ven., 1876).

throughout Europe, he mentions five additional examples of the "barchette" which, since the date of my monograph on the subject, had come to his knowledge—viz., two at Fontega, the later being in July 1895; three in Laibach Moor; and one at Pampow, stated, on the authority of Dr Robert Belts of Schwerin, to be then preserved in the Museum of that town. Sig. Lioy does not inform us whether or not this is a recent discovery, or has any history attached to it, hence its value here is merely to add one more to the number. I may mention that when I last visited that Museum (August 1896) I saw no object of this kind; but, of course, it might not have been publicly exhibited, or perhaps, as the antiquities in this splendid collection are not very systematically arranged, it was simply an overlook on my part.

From the title of his paper, it may be inferred that Sig. Lioy does not accept any of the suggestions hitherto advanced in regard to the use of these objects as a satisfactory explanation of their true function, although he candidly admits that he has no better to offer. He points out that, with the exception of Laibach and Fontega, such relics have not been found in the vicinity of any of the well-known sites of lake-dwellings. He also follows Professor Alfons Müllner in questioning the supposed connection between the *Biberfallen* and the lake-dwellers of Laibach, as promulgated by the late Karl Deschmann, on the ground that the latest example had been deposited since the lake became a peat-bog, and consequently that it belonged to a more recent

period than that in which the lake-dwellers flourished.[1] Sig. Lioy concludes his remarks by declaring his belief that the mystery which envelops those relics is as impenetrable as if they still lay buried in the peat-bogs.

Early in the following year the same author sent me a further communication on the "enimmatche barchette di Fontega," giving an amusing account of his efforts to solve the riddle of their existence. Admitting that the trap-theory is at least plausible, he tells us that for corroborative information he applied to experienced sportsmen, consulted all sorts of antiquarian records and books, and made inquiries among the older inhabitants as to the survival of any local traditions which would connect them with fishing or hunting; but all in vain. Just as he had abandoned all hope of being able to unravel the mystery, a learned friend informed him that he had seen in the Zoological Museum of the Jardin d'Acclimatation, in Paris, a *barchetta* similar to those found at Fontega, but apparently of recent construction. Sig. Lioy lost no time in asking for an explanation from the authorities of the Museum, and he at once received the following reply:—

Le piège *barquette*, également appelé Trappe à Castors, qui se trouve dans notre collection d'instruments de chasse et de pêche, a été acheté en 1891 à Monsieur Beuf, Conseiller Municipal à Arles (Bouches du Rhône); c'est un piège ancien mais non archaique, dont on se servait beaucoup, il y a une centaine d'années, pour capturer les Castors qui se trouvaient à cette epoque, en grande quantité, dans le Rhône. *Notre piège*

[1] Argo, 1894.

est presque neuf, et a été construit *il y a cinq ou six ans au plus ;* on en trouve de plus anciens, aux environs d'Arles, ou cet instrument de chasse était très apprecié. Tous ces pièges, aussi que celui que nous possedons, ont la forme du piège dont vous donnez la description dans votre brochure, et les vôtres seraient en touts points identiques, si les deux barquettes (barchette che si rinvennero anche alla Fontega, ma rotte e strappate dai tagliato ri di torba) servant de ressort aux palettes, y figuraient.[1]

Notwithstanding the preciseness of this explanation, which so far confirmed Karl Deschmann's original opinion, Sig. Lioy was still unable to reconcile it with the absence of any traces of the beaver at Fontega or Fimon. He therefore thought it prudent to write to M. Beuf, the Arles councillor, from whom, according to the above letter, the Paris machine had been purchased. This gentleman politely replied that beavers were now caught on the banks of the Rhone by nets, and that wooden objects, like that sent to Paris, were primitive machines used by the hunters in Camargue for catching game (*pour prendre gibier*). For further particulars he referred him to M. Pichot, editor of the 'Revue Britannique,' and a well-known writer and authority on the habits of the beaver. M. Pichot's reply was as follows: "Je connais bien la Camargue et la Provence, et je n'ai jamais vu employer le piège du Musée; on prend les Castors avec un filet tendu dans l'eau devant la sortie de leur terrier." He also explained that his colleague, M. de Claybrooke, being interested historically in the various methods and appliances used for trapping animals, had placed the apparatus in question in the

[1] Atti del. R. Ist. Veneto di Sci., &c., vol. vii. § 7, p. 161.

collection. But the *coup de grâce* came from M. de Claybrooke, who declared that the "barchetta" was simply a reproduction of one of those found at Laibach and shown at the Exhibition of Agriculture and Forestry held in Vienna in 1891.[1]

But this somewhat tantalising result of his inquiries did not prevent our indefatigable investigator from being once more decoyed by another *ignis fatuus*. M. Pichot, after warning him not to place too much reliance on hearsay stories, incidentally mentioned a rumour to the effect that floating traps, similar to the Laibach ones, were used to catch otters in the valley of the Saar in Alsace. But this rumour also came to nothing; for on applying to Dr Box, the author of 'Notices sur le Pays de la Sarre et en particulier sur Sarreguemines et ses environs' (Metz, 1895), he was informed that the otters of the valleys of the Saar and Moselle were caught in traps, called *assommoirs*, which had nothing in common with these ancient machines from the peat-bogs. These latter he considered too small to catch animals whose bodies were as large as, if not larger than, the machines themselves. But at any rate he assured him that such objects did not exist then in that district "et n'y ont probablement jamais existé."

The upshot of Sig. Lioy's inquiries may be best described in his own words:—

Completa *débacle!* Non restava altro partito che ammainare

---

[1] M. de Claybrooke wrote to me, towards the close of 1895, asking if I could supply him with a copy of my monograph on the so-called "Otter and Beaver traps"; but unfortunately I was unable to meet his wishes, as all the copies had already been dispersed.

le vele, confessare ancora con l'archeologo di Edimburgo; "nobody had never seen anithing of the kind" (*sic*),[1] e sugli scaffali ove si conservano tali oggetti incidere il motto scolpito sulle sepolture di cadaveri d'ignoti, travolti nei precipizi alpini o sotto a valanghe di neve: *Deus solus nomen scit.*

More Examples in North Germany.

But to come back to the region of practical research, I have to state that, in addition to the five new specimens recorded by Sig. Lioy, three more are in the Museum für Völkerkunde in Berlin and one is in the Provinzial Museum of Danzig, all of which were seen by me in the autumn of 1896. They are labelled as coming from neighbouring localities, but I could gather little reliable information as to their history. They are all much decayed and *minus* the valves; but the framework clearly shows that they were constructed on the same principles as those previously described. The Danzig specimen is particularly noteworthy as having only one valve closing the central aperture, being the first of the kind found on the Continent of Europe. Hence the classification into *univalvular* and *bivalvular*, by which the Welsh and all the Irish specimens were included in the former, and all the Continental ones in the latter, holds no longer good. It is only 24 inches long, but it is significant that the

[1] The words in this quotation were originally used to express the ignorance of the Irish antiquaries with regard to the "antique wooden implement" found at Coolnaman when it was first presented to them (see p. 252).

central aperture is not correspondingly small, as it measures 11½ inches by 3½ inches. Dr Conwentz informs me that it was found in 1877 in Lubochin, near Schwetz on the Vistula, at a depth of one metre. The owner gave it at first to a local museum, but in 1892 it was brought by Dr Conwentz to the Museum in Danzig, and a notice of it appeared in his annual report for that year.

After these notes had been written Dr Conwentz sent me a newspaper cutting,[1] which contained information to the effect that some four *Otterfallen* had just been discovered in the nursery of Herr Bluth in the Schüzenstrasse, Steglitz, at a depth of 1·50$^{m.}$ in the earth, and 5$^{m.}$ distant from the present bed of the Bäke. From the description of these objects there could be no question as to their character, although they were much decayed. As it was also stated that the distinguished antiquary Dr Voss, director of the K. Museum für Völkerkunde, had visited the scene of the discovery, I thought it advisable to ascertain his opinion of the objects in question before giving currency to the intelligence thus conveyed to me. I may also mention that, according to the newspaper report, a bronze ring was found in association with the wooden traps. In reply to my inquiries Dr Voss informed me that, with the exception of the locality—which should have been Gross-Lichterfelde, Kreis Teltow, and not Steglitz—the statements in the newspaper paragraph were correct. He also very kindly sent me the following statement of

[1] National Zeitung, Berlin, 6th January 1897.

the measurements of all the traps which had been sent, up to date, to the Museum :—

	Place of finding.	Length. cm.	Breadth. cm.	Thickness. cm.
1.	Halensee, Kreis Teltow	92	25	8·5
2.	" "	82	21	5·5
3.	" " (fragment)	...	...	...
4.	Liebenwalde, Kreis Nieder Barnim	90	27	6·5
5.	Gross-Lichterfelde, Kreis Teltow	68	13·5	5·5
6.	" "	62	13·5	3·5
7.	" "	65	14	5·5
8.	" "	58	12	4
9.	" "	60	?	4
10.	" " (a fragment)	?	10	?

The last six are those recently discovered. All the ten specimens are made of oak, and were found in the province of Brandenburg.

Recent Discoveries in Laibach Moor.

It will be remembered that the late Dr Karl Deschmann associated the two specimens of traps first found in Laibach Moor with the time of the lake-dwellings in that locality, partly on the ground that they lay about the same depth in the peat as the relic-bed of these structures. In conversation with him and his assistant, I remember that the exact position of the traps in the peat was regarded as doubtful, as it rested on unskilled evidence given long after their discovery. On the other hand, Professor Alfons Müllner, who has put on record the facts in connection with the discovery of the most recent example—viz., that found by Johann Keslor in the summer of 1894—finds nothing in the circumstances which would lead him to associate it with the lake-dwellers,—an opinion which he is inclined to regard as applicable to all the Laibach traps.

Through the courtesy of Professor Müllner I am enabled to give a short account of this discovery. The trap was found in a portion of the moor not yet converted into cultivated land, and only utilised as a peat-bog. The locality lies to the west of the road to Brunndorf, in the vicinity of the sites of the lake-dwellings; about 5 kilometres from the town of Laibach, 3 from the east shore, and 5 from the north shore—*i.e.*, the ancient shore of the lake. At the spot where the trap lay, a section from above downwards showed the following distinct beds (Fig. 99) :—

1. A superficial deposit of turf (*Abraumtorf*), about 12 inches thick.
2. A dark consolidated stratum of peat used as fuel (*Torf-Šota*), about 16 inches thick.
3. A fibrous kind of peat unsuitable for fuel called *Felzentorf*, about 27 inches in depth.
4. A muddy deposit (*Brauner Lehm*) containing the remains of decomposed plants said to be the corresponding stratum to that in which the lake-dwelling relics were found—16 inches thick.
5. A light-grey clayey deposit of unknown depth containing shells, and described as the ancient bed of the lake.

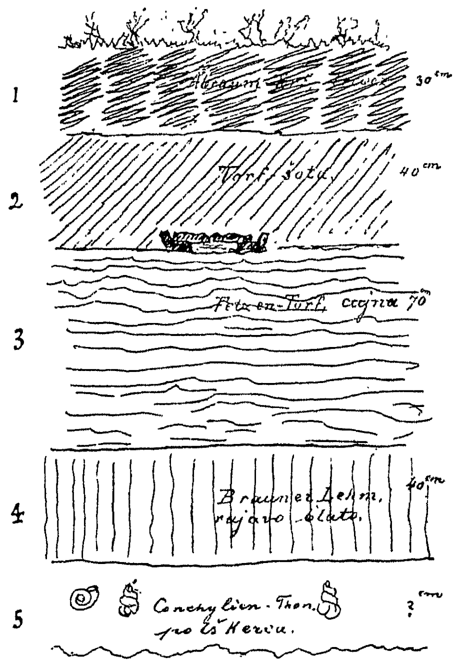


Fig. 99.—*Section of the Deposits in Laibach Moor.* (*After Müllner.*)

The trap was lying in a horizontal position between the deposits numbered 2 and 3, about $2\frac{1}{4}$ feet below

the surface of the moor and 3¾ feet above the ancient lake-bottom. Along with it was a short prepared piece of wood, supposed to have been used in keeping the valves open when the trap was set. From these data Professor Müllner draws the inference that the trap had not floated to its position, but had been placed there subsequent to the time when the peat began to grow in the locality, and of course long after the period of the lake-dwellings. This is the third specimen sent to the Museum at Laibach—the two others which are known to have been dug up having been lost. The first and the most perfect of all (Fig. 92) is made of oak, but the other two are said to be of elm—the valves only being of oak. On the under side of the valves of the two latter there was noticed a hole, intended, according to Professor Müllner, for the wooden pin (*Spreizholz*) which kept the valves open. According to the same authority the workmanship of all these traps betrays the use of tools of a more modern type than were in the possession of the lake-dwellers.

Beaver-trap Theory questioned.

But although Professor Müllner's induction appears to be in harmony with the chronological range of many of these machines found elsewhere in Europe, it does not demolish Dr Deschmann's opinion that they were beaver-traps. That the lake-dwellers hunted the beaver was clearly established by the fact that its bones were more numerously represented in their

food-refuse than those of any other wild animal. This shows that beavers were very abundant in Laibach Moor when it was an extensive sheet of water, as was the case in the early Bronze Age, and we cannot suppose that they became suddenly extinct in the neighbourhood. Neither can we suppose that the people who constructed the pile-structures disappeared from the locality when their peculiar habitations were abandoned and fell into disuse. In subsequent and more settled times they merely shifted their dwellings to the adjoining lands, where, probably, their descendants still live. But in the midst of these changes the people would not give up their hunting expeditions. No doubt, as the district became more populous, the wild animals would be gradually getting scarcer, until ultimately some of them became extinct in the neighbourhood—a fate which undoubtedly overtook the beaver. When this final event took place history does not record; but at any rate it must have been subsequent to the time when lake-dwellings ceased to be the general system of habitation.

Beavers are said to survive in some parts of Europe to the present day; if so, these must be very few indeed. Under the word "Castor" in the 'Encyclopédie Universel Raisonné' (1771), beavers are said to be then extant in Languedoc and in the islands of the Rhone, but more numerous in the northern provinces of Europe. The mode of hunting them, which was chiefly carried on in winter, is thus described:—

On les tue à l'affut; on leur tend des pièges amorcés avec du bois tendre et frais, ou on attaque leurs cabanes dans les

tems des glaces; ils s'enfuient sous l'eau; et comme ils ne peuvent pas y rester long-tems, ils viennent pour respirer à des ouvertures qu'on a pratiquées à la glace, et on les y tue à coups de hache. D'autres remplissent ces ouvertures avec de la bourse de l'épi de typha, pour n'être pas vus par les *castors*, et alors ils les saisissent adroitement par un pied de derrière."

Another argument which Professor Müllner advanced in support of his contention was derived from the analysis of some fibrous material, like the hairs of animals, observed sticking in the crevices of the wooden machine after it became dried by exposure. Portions of this substance were collected from different parts of the framework, and made into six microscopical slides. These were, on the recommendation of Dr Voss, submitted for examination to Dr R. Möbius of Berlin; and the following was the result of his report:—

No.
1 = Wood- and plant-fibres.
2 = Wood-fibres and plant cells.
3 = Wood-fibres and torn hog's bristles (*Abgeriebene Schweineborste*).
4 = Wood-fibres and the hair of cattle.
5 = Hair of the fox [?].
6 = Wood-fibres, upper and under hair of the hare, human hair, and a bluish wool.

Dr Möbius appended a note to the effect that the hog-bristles probably came from the brush used in cleaning the apparatus, and the wood-fibres were from its dessicated surface. Hairs, he observed, were easily blown about, and could readily get access to such an object.

On the strength of this report Professor Müllner suggests that it might have been used to trap the

hare, but whether or not this was the case, he concludes that there was nothing whatever to indicate that it was a beaver-trap — "Soviel ist heute sicher für die Bestimmung, Bieber damit zu fangen, spricht kein Umstand."[1]

The Hoard of Traps in Larkhill Bog.

In following up the clue so kindly given by Dr Fraser, as already mentioned, my first step was to communicate with Hugh Allingham, Esq., M.R.I.A., Ballyshannon, from whom the news of the discovery had originally emanated. From this gentleman's first letter I saw that the affair had fallen into the hands of one who was both competent and willing to inquire into the matter, and all I could do was to send him some literature to assist him in his investigations. The whole story is so clearly set forth in his letters that it is unnecessary to break the narrative by any interpolations on my part. On the 27th October he writes as follows:—

In accordance with my promise, I visited the spot where the wooden articles were discovered on Wednesday last, and I now submit the following particulars, and send you herewith photos of three of the articles (Fig. 100), and of the ground where they were found. If I have omitted anything you wish to know further, please let me know. The place where the traps were found is in a bog, called Larkhill Bog, Co. Fermanagh, about 1½ mile east by north of Castlecaldwell Railway Station. This bog is situated in a hollow beneath a hill, and from its appearance and situation seems to have been the site of a former lake

[1] Argo, p. 239.

of small dimensions. In fact there are old people living in the locality who remember when the lake existed. I am informed that the making of a road, which traverses the district, cut off

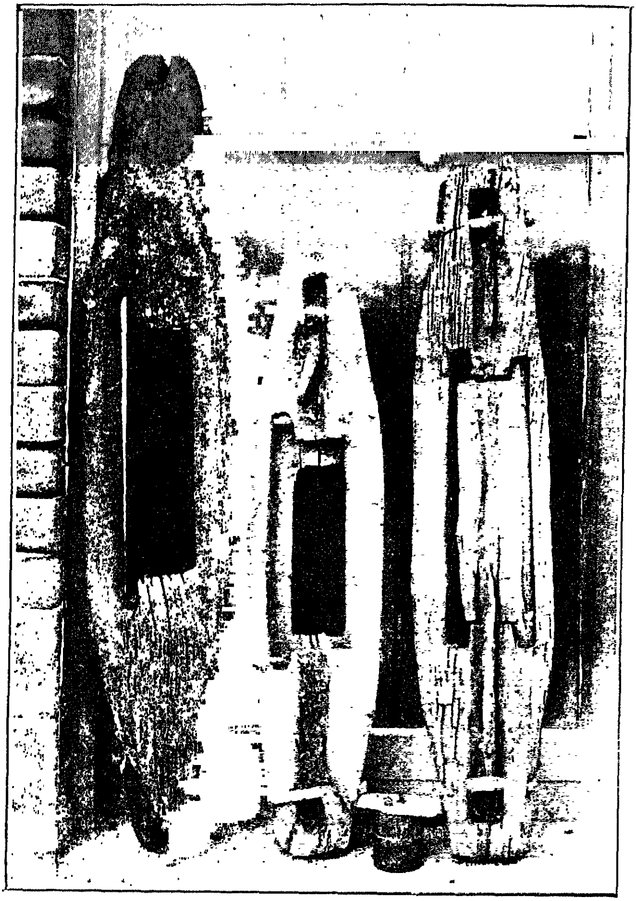


Fig. 100.—*Supposed Otter-Traps found in Larkhill Bog.*

the water-supply, and made it possible to drain the lake, which now consists of a swampy bog of black peat. Some countrymen went during the summer to this bog in order to cut turf

for fuel, when they came upon the traps. They were not more than three feet from the surface, and were in an almost upright position, being (I am informed by a man who was present) in the position shown in the accompanying diagram (Fig. 101). The first or upper two were 1 foot apart, and at a similar distance the others in each row were placed. The middle one in the base line is, however, 1½ foot from that on the right and left side of it.

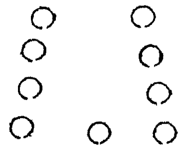


Fig. 101.—*Diagram showing relative position of the traps.*

Nine traps in all were found, but no trace of anything else either in wood, stone, or metal. It appears that the men were somewhat alarmed by the discovery, regarding it with that superstitious feeling which is so common amongst the country-folk. Thinking they were coffins belonging to some forgotten race of dwarfs, they at once gave up further search in the peat, and since then all operations in that part of the bog have been discontinued—the place being regarded as uncanny. I did not consider it necessary to photograph the entire nine traps, as they are all of the same pattern and construction, the only difference being in size, and so selected three good specimens, which give a fair idea of the whole. I should mention that they are now in the possession of J. C. Bloomfield, Esq. of Castle-caldwell, who kindly afforded me every facility for their examination. This gentleman had not the slightest idea of what they were, his opinion being that they were some kind of primitive weaving-loom. I would call your attention to the fact that in a piece of wood which appears to have formed part of the mechanism of the trap, portions of *two small iron bolts* remain. They are flat-headed, and almost in a state of crumbling away with rust. I have placed them at the foot of the traps in the picture, so that you can see what they are like. One of the traps (the longest one) I have put with the underside in front, in order to show the bevelling. The cutting of all the specimens seems to have been done with a very rude tool. All the traps are *single-valve ones*, and remains of the springs are still to be seen in all of them. These latter are of wood (hazel) more perishable than the oak which forms the bodies, and

consequently are greatly decayed; but the bark still remains on them.

The following are the measurements of the largest and smallest examples now found:—

Largest Trap.—Length, 48 inches; greatest width, 9 inches, tapering at both ends, as all the traps do; rectangular opening, 17 inches by 5; bevel on underside, 29 inches by 8, valve absent, but a small portion of wooden spring remains; the springs, which are in a decayed state, are of hazel. The smallest trap is 35 inches in length, 8 inches broad, and 3 inches deep (the approximate depth of all the specimens found); the opening is 10 inches by 3, and is well bevelled on the underside. In the example shown in centre of illustration, the valve which is absent appears to have been retained in position by two small wooden pins which still remain (see illustration). In the centre of each of the existing valves is a hole of oval shape, which seems to have been burned through rather than bored with a tool, and the back of valve is marked with a groove for the spring to work in.

I have pleasure in stating that I received valuable assistance in the examination of these objects from R. H. Creighton, M.B., who kindly came with me to the spot.

On the 10th December Mr Allingham supplements the above account by the following remarks:—

In reply to your query as to the probable size of the lake where the Larkhill Bog now exists, I have to say that, so far as I can learn, it was never a large one—merely a pond surrounded by a marsh. There is a small river close at hand which (before the making of a road and bridge) used to supply most of the water to this lake or pond. The bog is at considerable distance from Lough Erne, and is at a much higher level than that lake. It does not seem at all a likely place for otters to frequent, as these animals would come where fish are to be had, and having a good supply at all times in the extensive waters of Lough Erne, they would not have any inducement to come up there. There are, of course, plenty

of pike in Lough Erne, but they are not usually found in the smaller lakes which abound in this district.

No traditions exist as to these traps. None of the peasantry ever saw or heard of anything like them having been in use. From this fact, and knowing that the people here are very conservative of old practices and appliances, many of which, though dating back centuries ago, are still fresh in their minds, I am strongly of opinion that these traps, whatever they were used for, belong to *a much older period* than some persons seem to think. Reasoning from the survival of other things, not more remarkable than the traps, which reach back for many centuries, and are still familiar with the peasantry, it seems hardly possible that such implements could have been used one, or even two, centuries ago, and be now unknown and forgotten.

The grouping of the Larkhill traps in such a peculiar manner seems to indicate that they were so arranged for preservation or concealment. It might be that at the end of the hunting season they were hidden amidst the overgrown rushes on the margin of the loch by being placed on end in a series of holes where they could be readily found when again required. But, alas! a time came when they were no longer sought for, and so they became gradually entombed in the growing peat. What the reason was for this neglect or forgetfulness it is impossible to conjecture. Perhaps the trapper himself was suddenly summoned off the scene. Or perhaps the quarry had got scarce, and the sport being no longer lucrative, the useless traps were allowed to remain in their place of concealment. And now, after an unknown, but evidently long, interval, they are accidentally disinterred as relics of a sport which has since completely fallen into oblivion.

One noteworthy point in regard to this hoard is that the trap-theory of their function is placed beyond doubt. The trap shown on the right of Fig. 100 represents it in a state of rest—*i.e.*, not "set," but still retaining nearly all its integral parts, especially the valve and its superjacent "spring," *in situ*. Mr Allingham has directed attention to the slight hollow on the upper surface of the valve caused by the friction of the elastic rod. We may compare with this the friction markings of the spring on the one found near Broughshane, and described at p. 260. From such evidence it may be safely concluded that these objects were not mere toys, but ingeniously and specially contrived machines for capturing some kind of animal—in which capacity they appear to have been long in use.

The presence of the flat-headed iron nails or bolts is interesting, as showing that whether or not they were integral parts of the apparatus, the traps belonged to the Iron Age.

General Remarks.

That the animal hunted was aquatic in its habits and disposition is forcibly suggested by the nature of the localities in which these traps have been found, for in every instance in which this has been determined with accuracy it was the bed of a former lake, or in close proximity to a river. Such was the case at Fontega, Laibach Moor, the Larkhill bog, and the recent German find at Gross-Lichterfelde, which account for twenty-five of the total of thirty-five hitherto recorded; and of

the remaining ten more than the half are known to have been dug out of peat-bogs. It may also be noted that the Larkhill and Gross-Lichterfelde "finds" are distinguished by having more than one trap in the same spot — all the others having been disinterred singly—which shows that the former were hoards, as it is impossible to suppose that when in use so many would be set in such close proximity to each other. The absence of any record of decayed pieces of wood along with these two hoards leaves the actual method of setting the traps as great a mystery as before. On the supposition that *otters* or *beavers* were the game for which the trap was intended, the bait must have been attached to the wooden pin which kept the valve or valves open, at such a height above their free edges as to force the animal to insert its head clear above them when in the act of mouthing the tempting morsel. Otherwise the valves on becoming free would merely press the animal's head backwards without closing on its neck. On the theory of Dr Meschinelli—viz., that they were traps for catching water-fowl—the bait must have been placed in the water below the level of the closed valves. It is conceivable that ducks and geese, when thus allured, would get their necks jammed between the two valves, or between the valve and the edge of the framework in the case of a univalvular trap. On both these suppositions the bait must have been attached by a string and some kind of mechanism involving an adjustment of slender pieces of wood.

As to Professor Müllner's suggestion about the hare, I can only say that it is difficult to conceive how the

apparatus could be worked so as to trap this animal. I also see that Dr Fraser, in his note on p. 263, mentions the pike as an alternative to the otter. But this supposition, though more feasible than Professor Müllner's, is also improbable when subjected to the test of practicability. If such machines had ever been successfully used for catching pike, there is no reason why the method should have been abandoned, as the fish are still abundant in many localities.

I have already directed attention to the fact that the central aperture in some of these traps is bevelled off on the under side, so as to present a smooth gaping-like opening. This feature has been particularly noticed in the specimens from Fontega, Wales, and Ireland, and was most likely common to them all. Without being aware of the importance attached to this part of the mechanism, one is apt to overlook a point, apparently so trivial, in describing the apparatus. Mr Allingham has, however, figured the underside of one of the Larkhill group, so as to exhibit the bevelling, and he observes that it was common to all the specimens. In my opinion its object was to facilitate the ingress of the head of the animal in this direction; and I, therefore, adhere to the opinion that the *otter* and *beaver* are the two most likely animals to be trapped by such a piece of mechanism. But, notwithstanding all that has been said, I fear the problem still remains *sub judice lis;* nor can the epithets "enimmatiche barchette" and "die räthselhaften Fallen" be yet characterised as inappropriate.

[After the final proof-sheets of the context had been corrected, Mr Allingham (March 29th) directed my attention to the following extract from Sir W. Wilde's Catalogue of the antiquities in the Museum of the Royal Irish Academy, p. 279: "When the country was more than half covered with wood, and the mountain-passes and rocky fastnesses afforded secure retreats to the wolf, the fox, the badger, the martin, and probably the squirrel, *and the rivers' banks swarmed with otters*,—their warm furs afforded the natives, in great plenty, a means of clothing and decoration, not now procurable except by importation. Even long after the great bulk of our forests had been submerged in bog, or were cut down, peltry formed a considerable article of traffic, and also a portion of our exports; and all the Irish chieftains, down to the seventeenth century, of whom we have any picture or accurate description, appear to have been decorated with fur."

To these remarks Sir William appends the following as a footnote: "As many as 169 otter-skins were claimed by the English Exchequer at Dublin in 1408, from the representative of the family of Gillamochalmog, as arrears of his rent for Radon." See Gilbert's 'History of Dublin,' vol. i. p. 233.

"Evidently," writes Mr Allingham, "both the supply and demand for these animals were formerly much greater than in modern times, and no more likely habitat could have been found in all Ireland than Lough Erne and its tributaries. The fact of otter-skins having been so extensively used in Ireland for head-gear and other personal adornment—besides passing as a rent-paying medium—goes far to support the theory that the Larkhill hoard of traps had been actually used for the capture of these animals."]

Literature.

In order to assist my readers to follow the various steps by which the homogeneity of these widely distributed traps was established, I subjoin a concise statement of the literature on the subject, arranged,

as far as possible, in chronological sequence. It is to be noted that many of the authors of the articles here tabulated were, at the time of writing, ignorant of the existence of analogous remains elsewhere — a fact which accounts for the diversity of the earlier explanatory suggestions made as to their functional use. But though many of these suggestions are wide of the mark, their record has not been in vain, as without such notices the objects in question could not have been collated; and in all probability they would have still remained unknown to archæologists. The incidents of their discovery and identity afford one of the most interesting object-lessons of the importance of comparative archæology which has come under my knowledge.

1859.

Editor: Ulster Journal of Archæology, vol. vii. pp. 165, 289.

"Antique wooden implement" extracted from a bog in the townland of Coolnaman, Ireland, figured and described.

1873–1874 and 1877.

Dr Hildebrandt: Zeitschrift für Ethnologie, vol. v. (Verhand., p. 119.)

Wooden machine found in a peat-bog, figured and described as part of an apparatus for retaining fish (*Fischbehältniss*).

Professor F. Merkel: Zeitschrift für Ethnologie, vol. vi. p. 180, 1874.

A similar object found in the Moor of Samow near Gnoien. According to the opinion of its discoverer, Mr Boldt, it was a trap for catching otters.

Mr Friedel: Ibid., vol. ix., p. 162, 1877.

A so-called *otter-trap*, found in a peat-moor near Flatow, West Prussia, was sent to the Märkisches Museum in Berlin.

1878.

Mr E. L. Barnwell: Archæologia Cambrensis, vol. x., 4th series, pp. 4 and 188.

A wooden object, dug up by the tenant of Nant-y-rast farm, parish of Caio, while cutting peat, lay for three years on the bank of the peat-bog till secured by Mr J. Davies, August 20, 1878. Supposed to have been a musical instrument, but some six months later, after it had been ascertained that a similar object was described in the 'Ulster Journal of Archæology,' this opinion was abandoned, and the writer suggests that it was a machine for making peat-bricks.

1880.

Dr Karl Deschmann.

Two wooden objects of unknown use found in Laibach Moor, and sent to the Landesmuseum at Laibach. They were labelled *Biberfallen.*

1889-90.

L. Meschinelli: "Studio sugli Avanzi preistorici della Valle di Fontega." Atti della Soc. Veneto-Trentina di Scienze Natur., vol. xi., 1889.

Three wooden objects found in the valley of Fontega—one of which is figured—and supposed to have been models of prehistoric boats. See also 'Bull. di Palet. Ital.,' *An.* xv. p. 128, and *An.* xvi. p. 144.

——— "Su Alcuni Strumenti di legno provenienti da varie abitazioni lacustri di Europa." Rend. della R. Accad. delle Sc. Fis. e Mat. di Napoli., 1890.

In this article Dr Meschinelli, collating the discoveries made in other parts of Europe now brought under his notice, recognises the complete analogy between the *piroghe* of Fontega and the objects found in Laibach and North Germany. See also 'Bull. di Palet. Ital.,' *An.* xvi. p. 44.

1890-91.

R. Munro: The Lake-Dwellings of Europe, 1890, pp. 179-184.

In this work the area of distribution of the so-called Otter and Beaver traps is still further extended, and illustrations of similar objects are published from Styria, Italy, North Germany, and Ireland. See also 'British Assoc. Reports' for 1890, p. 978.

R. Munro: "Notice of some curiously constructed wooden objects found in peat-bogs in various parts of Europe, supposed to have been Otter and Beaver traps." Proc. Soc. Antiq. of Scot., vol. xxv., 1891.

In this communication the list of traps was enlarged by the recognition of a specimen found in Wales and another in the collection of the late Canon Grainger in Ireland.

1891.

G. R. Buick: "Notice of an Ancient Wooden Trap, probably used for catching otters." Journal R.S.A. of Ireland, vol. xxi. p. 536.

This is a notice of the one above referred to as being in Canon Grainger's collection, with an excellent illustration, now noteworthy as having been the means of enabling Mr Allingham to identify the *dwarf coffins* recently resurrected near Ballyshannon.

1894.

Alfons Müllner: "Die räthselhaften Fallen von Laibacher Moore." Argo—Zeit. fur Krain. Landeskunde, 1894, pp. 153, 175, and 237.

1895.

Paolo Lioy: "Le misteriose Barchette della Fontega (Fimon)." Atti del. R. Ist. Ven di Sc., vol. vi. series vii., 1894-95.

——— "Ulteriori Notizie sulle Enimmatiche Barchette di Fontega." Ibid., vol. vii. series vii., 1895-96.

1896.

H. Allingham: "Wooden objects found in Peat-Bogs, supposed to have been Otter-Traps." Journal R.S.A. of Ireland, 1896, p. 379.

The author gives a description of the finding of no less than nine of the traps in one place in the Larkhill Bog, Co. Fermanagh, Ireland.

1897.

A. Voss.

In a communication to the author of this work Dr Voss gives particulars of the discovery of six traps dug up on the bank of the Bäke at Gross-Lichterfelde near Berlin.

CHAPTER VII.

BONE SKATES, AND THEIR ARCHÆOLOGICAL RANGE IN EUROPE.

Difference of Opinion as to the Antiquity of Bone Skates—Found in the *Terpen*—Some preserved in the Museum of Northern Antiquities—Found on the sites of Lake-Dwellings in North Germany—Found in the *débris* of the ancient town of Birka—Found on the East Coast of England—General Conclusion—Appendix.

As, in a syllogism, the conclusion is necessarily involved in the premisses, so in archæology, every general inference must depend upon the accuracy of the observed facts. More especially is this the case when the problem at issue is of a complex character, such as the determination of the range of a given group of objects in space and time.

The contradictory opinions enunciated by archæologists in regard to the period when bone skates were used justify the following attempt to define their position in early European civilisation with greater precision than has hitherto been done. Accordingly, I shall ask your attention while I take a rapid survey of the circumstances in which so many of these primitive implements have been found.

Bone Skates found in Terpen.

During the summer of 1888 I visited Holland, mainly for the purpose of making inquiries as to the nature of certain remarkable mounds called *Terpen*, irregularly scattered over some of its low-lying districts, more especially Friesland, which in recent times have been found to be rich repositories of the industrial remains of the earlier people who inhabited the country. As I have already published an account of those mounds from an archæological point of view,[1] I need not now occupy time by repeating details which, however interesting, could only be regarded as preliminary to the subject of this paper. One observation only I must ask you to bear in mind—viz., that they are the *débris* of ancient marine pile-dwellings which flourished, at least, from the time of Pliny down to about the twelfth century. A few years ago agriculturists discovered that the contents of these *Terpen* were possessed of highly ammoniacal properties, which have been since utilised as guano. For this purpose the *Terp* at Aalzum, one of the largest in Friesland, was being excavated at the time of my visit, and so I took the opportunity of examining it, under the guidance of Mr Corbelijn Battaerd, Conservator of the Leeuwarden Museum. It seems to be an essential law in this part of the world to submit all antiquarian objects collected in the course of the excavations to the authorities of the Museum before being offered to outsiders, so as to give the former an opportunity of acquiring whatever

[1] Lake-Dwellings of Europe, pp. 333-348.

articles may be considered of national interest. On this occasion the workers—a number of men and women—produced their little hoards for the inspection of Mr Battaerd; and after he had picked out certain objects for the Museum, I selected a few portable things, which, on my return home, were presented to the National Museum in Edinburgh. Among these relics was the bone skate here figured (Fig. 102). It is

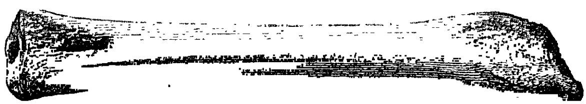


Fig. 102.—*Bone Skate from a* Terp-*Mound at Aalzum.*

formed of the metacarpal bone of a horse, and is highly polished with use on one side. It measures 9 inches in length, but, with the exception of a small hole at one end, shows no marks by which it could be attached to the foot. There was at the time of my visit a small collection of similar skates in the Leeuwarden Museum; but since the *Terpen* have been so largely excavated, bone skates have become too common to be of much antiquarian value. In looking over the list of objects acquired for the Museum during the year from October 1889 to October 1890, I find notices of fifteen bone skates. The largest (characterised in the 'Proceedings' of the Friesch Genootschap as extraordinarily large) was found in a *Terp* at Bilgaard, and measures 11 inches in length; the shortest is only 4½ inches in length. Their average length is about 9 inches. Three are described as having a hole at one end; one as being

greatly worn by use; and four as fragments. In the following year the addition to the collection of bone skates was less, being only ten—one pair of them having been found in the walls of an old building in Leeuwarden.

In East Friesland mounds similar to the *Terpen* are called *Warfen*, and among the industrial remains disinterred from them are also bone skates. One, "in einem Warfe bei Grimersum gefunden," is figured by Dr Tergast in a small work entitled 'Die Heidnischen Alterthümer Ostfrieslands.' This author, however, considers that such objects were used as polishers, and describes them as "Knochen, an einem Seite polirt, zum Glätten des Gewebes."[1]

The late Dr Lindenschmit figures two bone skates,[2] one from the Museum at Hanover and the other from the Museum at Leiden. The origin of this latter example is supposed to be more precisely defined by adding the words "gefunden in einem Grabhügel bei Oosterend in Friesland." Dr Lindenschmit also states that similar objects had been found in the provinces of Zeeland, Utrecht, and Geldern.

Preserved in Museum of Northern Antiquities.

Baron van Breugel Douglas, in an article on the *débris* of ancient hearths in Friesland, read at the International Congress of Anthropology and Prehistoric Archæology held at Copenhagen in 1869, thus refers

[1] P. 43, and Pl. vi. Fig. 49.

[2] Alterthümer unserer Heidnischen Vorzeit, Heft xii., Taf. i., No. 1 bis 4.

to bone skates exhibited in the Museum of Northern Antiquities:—

Avant de finir je me permets de faire à M. le Directeur du Musée des Antiquités du Nord une observation sur des objets qui se trouvent dans une des vitrines de la XV^{e} salle (moyen-âge). Ce sont des os droits et polis d'un côté et perforés aux deux bouts d'un trou, connus en Frise comme les patins des anciens Frisons.

Je pense que ces objets doivent être placés dans le premier âge de la classification adoptée, celui de pierre, qui contient aussi d'autres objets en os, aussi bien qu'en corne ou en arêtes. Je sais bien qu'on s'en est servi encore dans des temps postérieurs, mais ce fait ne decide pas la question de l'âge dans lequel ils doivent être placés. A mon avis, c'est celui de leur invention.[1]

On the Sites of Lake-Dwellings in North Germany.

Bone skates are among the relics found on several of the lake-dwellings in North Germany. The settlements in the Persanzigersee and in the Dabersee, both of which were contemporary with the Burgwälle, have yielded a few specimens associated with other relics described as of Slavish origin. Another specimen, figured in 'Lake-Dwellings of Europe' (Fig. 99, No. 14), was found on the *Packwerkbau*, in the Kownatkensee, East Prussia. It is about 9 inches long, and presents a flat surface, highly polished by use. Among the other industrial objects from the same locality, exhibited in the Prussia Museum, Konigsberg, were a small stone axe, a worked flint,[2] and some pottery, ornamented with finger- and string-marks (*Schnurornament*).

[1] Compte Rendu, p. 181. [2] Ibid., Nos. 12 and 13.

Herr von Schab figures a bone skate from the lake-dwelling in the Lake of Starnberg, Bavaria.[1] The assortment of relics from this settlement, deposited in the Archæological Museum at Munich, seems to me to contain stray objects from different civilisations. A horse-shoe with six nail-holes, two iron spears, and a remarkable iron knife of large size,[2] together with some worked objects of bone and horn,[3] undoubtedly belong to a later age than that of the actual lake-dwellers. There is a tradition that the island was originally the site of a heathen temple and a sacred burying-place, which became subsequently appropriated by the Christians, and was used by them for similar purposes. Some countenance is given to this tradition by the fact that the workmen, when digging the foundations of the present royal residence built on the ruins of an old ecclesiastical establishment, came upon sepulchral remains of a mixed character—early mediæval, Roman, and prehistoric.

Among the heterogeneous *débris* of human occupancy in the "trouvaille de Toszeg" in Hungary, now recognised to be analogous in structure to the *Terremare* of North Italy, there was an object thus described in the 'Catalogue d'Exposition préhistorique,' 1876: "Un os troué aux deux bouts ayant peut-être servi de Patin."

Another locality said to have yielded a bone skate is the lake-dwelling at Moosseedorf, near Bern. This statement is of some consequence, because if this object

[1] Keller's Swiss Lake-Dwellings, 2d. ed., Pl. clxxxii. Fig. 36, and p. 593.

[2] Lake-Dwellings of Europe, Fig. 37, No. 1.

[3] Ibid., Fig. 36, No. 26.

can be authenticated as a genuine relic of the inhabitants of that settlement, we shall be compelled to relegate the origin of bone skates back to the pure Stone Age. The bone skate reputed to have been found on this station is figured in Keller's 'Lake-Dwellings of Switzerland,'[1] and described as follows :—

> One of the uses to which the long bones of animals were applied is singular. This figure is the sketch of a skate made out of the long bone of a horse. It is between 10 and 11 inches long. On one side it has the natural appearance of the bone, but on the other there is a flat polished surface, nearly 9 inches long and about half an inch wide. There are no perforations in the bone, but there are two incisions in front and two projections behind, which would allow of its being fastened to the foot. This specimen was first published by Messrs Albert Jahn and Dr Uhlmann in 1857 (Bern), and subsequently in several other quarters.[2]

It may be remarked that no notice of this bone skate has appeared in any of Keller's original reports on the *Pfahlbauten*, nor in the first English edition of his works published in 1866.

Found on the Site of the Ancient Town of Birka.

The most interesting group of antiquities in which bone skates are largely represented is that collected on the ruins of the ancient town of Birka, in Sweden. The explorations made on the site of this town are of great archæological value, inasmuch as they illustrate that most famous period of protohistoric times in Scandinavia known as the Viking period. The

[1] English 2d ed., Pl. cl. Fig. 6.

[2] Ibid., p. 39.

complete monograph on this great "find," which I understand is in the course of preparation by Dr Stolpe, is not yet published. The following extract from the guide to the National Museum at Stockholm, where the relics are preserved, will, however, sufficiently explain the circumstances for our present purpose:—

On the island Björkö, in Lake Mälar, stood the town of Birka, celebrated for its trade, and also for its being the first place where Christianity was preached in Sweden. The northern end of the island is almost completely covered with barrows, as well as three-sided, four-sided, and "boat-shaped" arrangements of stones. The number of such graves visible above the surface of the ground is over 2000, and their number has evidently been greater. Numerous other graves, containing unburned bodies, are not distinguishable above ground through mounds or arrangements of stones. It follows that during the latter part of the heathen period the island had a very numerous population, and the site of an ancient town can also be distinguished. Along the N.W. coast of the island stretches a cultivated field, more than 20 acres in area, known in common parlance as "Svarta jorden" (the black earth), the soil of which consists of a compound of charcoal, ashes, and sand, with quantities of animal bones embedded therein, together with ancient objects of all kinds. The investigations made by Dr Stolpe since 1871 have brought to light that the charcoal and ashes came from the hearths of the inhabitants whose houses were built here, and that the bones were the remains of their meals.

Dr Stolpe then goes on to describe the objects found in those different cemeteries, far too numerous and varied to be here even mentioned. He shows that the graves containing unburnt bodies were those of the inhabitants of Birka, who had been converted to Christianity by Ansgar and his followers.

The relics collected on the site of the town itself—*i.e.*, in the "black earth"—consisting of a vast assortment of implements, weapons, ornaments, fabrics, coins, food refuse, &c., &c., are then briefly enumerated. The entire collection from Birka gives a vivid picture of the social life of the period, and particularly of the inhabitants of that flourishing town, from its rise in the middle of the eighth century down to its final destruction about the middle of the eleventh century.

Among the miscellaneous objects from the "black earth" are bone skates, two dozen of which I counted in the Björkö collection when I last visited the Stockholm Museum, a couple of years ago. But these are merely specimens, and by no means represent the entire number collected. Dr Stolpe, in an address delivered to the members of the "Congrès International d'Anthropologie et d'Archéologie préhistoriques," on 13th August 1874, long before the entire excavations were completed, thus refers to the bone skates:—

En hiver, quand la glace recouvrait la surface du lac, on la parcourait sur des patins confectionnés d'os de bœuf ou de cheval, principalement les os du métacarpe et du métatarse et parfois le radius. Près de 300 patins pareils découverts pendant les trois dernières années, témoignent de la vivacité des communications sur la glace du Mälar. Ces instruments de locomotion paraissent avoir été tout aussi diligemment employés par les adultes que par les enfants. On se sert encore aujourd'hui de patins identiques dans plusieurs de nos provinces.[1]

In corroboration of Dr Stolpe's statement as to the

[1] Compte Rendu, p. 625.

survival of the custom of using bone skates to recent times, I may mention that specimens of them may be seen in the ethnological collections in Stockholm, one of which is engraved in the guide-book to the Northern Museum. I also saw some bone skates in the public museum at Visby, in the island of Gotland, in regard to which the curator remarked that he himself in his earlier years had actually used similar skates.

Bone Skates in England.

Let me now direct your attention to facts gleaned nearer home. In the year 1866 General Fox-Pitt-Rivers, at the Anthropological Institute of Great Britain and Ireland, described remains of pile-buildings exposed by workmen while making excavations for the foundations of a modern building near the site of a portion of the old London Wall. Here, in a bed of peat 7 to 9 feet thick, intervening between the accumulated rubbish of modern London and a bed of water-worn gravel, were found decayed wooden piles associated with the *débris* of kitchen-middens and a large assortment of industrial remains. The vast majority of the articles collected are undoubtedly of Roman workmanship, but amongst them were others of a ruder character, such as implements made of bone and horn, among which were two bone skates, thus described by the author of the paper above referred to :—

With them were also found the two bone skates on the table; they are of the metacarpal bone of a small horse or ass, one of which has been much used on the ice. Exactly similar skates,

also of the metacarpal of the horse or ass, have been found in a tumulus of the Stone period at Oosterend in Friesland: a drawing of them is given in Lindenschmit's Catalogue of the Museum at Mayence, &c. Others have also been found in Zeeland, at Utrecht, and in Guelderland, and there is a specimen in the Museum at Hanover. Professor Lindenschmit attributes all these to the Stone period, but the specimens on the table are evidently of the Iron Age, the holes in the back having been formed for the insertion of an iron staple. Similar skates have been found in the Thames, but they have not hitherto been considered to date so early in England as in Roman times.

Mr Roach Smith, in describing a bone skate found at Moorfields, in the boggy soil peculiar to that district, makes the following remarks:—

A large number of similar skates have been obtained, not only from this locality, but also from various parts of the city. Fitz-Stephen, who lived in the time of Henry II., in describing the sports of the citizens of London, says: "When that great moor, which washeth Moorfields at the north wall of the city, is frozen over, great companies of young men go to sport on the ice," &c. After enumerating the various modes of sliding, he continues: "Some are better practised to the ice, and bind to their shoes bones, as the legs of some beasts (tibias scilicet animalium), and hold stakes in their hands, headed with sharp iron, which sometimes they strike against the ice; and these men go on with speed, as doth a bird in the air, or darts shot from some warlike engine." . . . In Bishop Percy's 'Translations of Runic Poetry,' skating is alluded to as being one of the accomplishments of the North, of the highest character. Harold, in the poem called his "Complaint," says: "I know how to perform eight exercises. I fight with courage; I keep a firm seat on horseback; I am skilled in swimming; I glide along the ice on skates; I excel in darting the lance; I am dexterous at the oar; and yet a Russian maid disdains me."
. . . In the twenty-fourth table of the Edda skating is thus

spoken of: Then the King asked what that young man could do who accompanied Thor? Thielfer answered, that in running upon sçates he would dispute the prize with any of the Countries. The King owned that the talent he spoke of was a very fine one. . . .

Olaus Magnus speaks of the skate as being made of polished iron, or of the shank-bone of a deer or sheep, about a foot long, filed down on one side, and greased with hog's lard to repel the wet.

My friend Herr Worsäe of Copenhagen informs me that skates of bone similar to those in my possession have been found in Holland, in Scandinavia, and particularly in the southern part of Sweden. He also refers to a very curious passage in one of the old Scandinavian mythological songs, in which it is said that *Oller*, or *Uller*, god of the winter, runs on bones of animals over ice.

Formerly skates of bone were used in Iceland. Indeed, it appears evident that they were in general use in all parts of the North of Europe. I have been informed that they were not entirely superseded by the steel skates in London at the latter part of the last century.[1]

Three bone skates are engraved in the 'Proceedings' of the Archæological Institute (1848), in respect of which the following remarks are made:—

Skates formed of the leg-bone of a small horse or other animal, discovered in Lincoln. One side was shaved off, presenting a smooth, flat surface, and in some examples there is a transverse perforation through one end, doubtless to pass a strap, and at the other end another, in a lengthwise direction, which might receive a peg or hook, for the purpose of attachment to the foot. . . . One of the relics of this nature exhibited was of greater length and weight than is suitable for such use, and possibly was used with some kind of sledge, or as a "runner," to facilitate the removal of a boat; it was found

[1] Collectanea Antiqua, vol. i. p. 167.

in 1848, near an ancient canoe disinterred in forming the Great Northern Railway at Stixwold Ferry.[1]

Two of the above objects are now in the National Museum of Edinburgh; also three other bone skates dug up in Moorfields, London. The two from Lincoln, which are here represented (Fig. 103), are described in

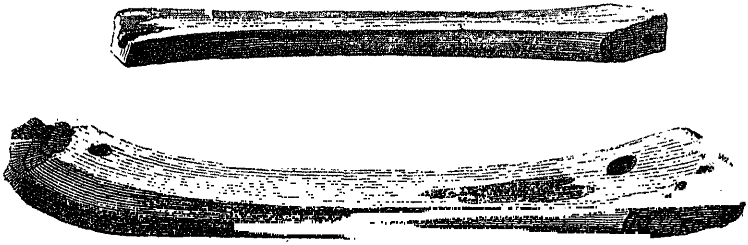


Fig. 103.—*Skate and Runner, each made of the leg-bone of a horse, found at Arches, and Stixwold Ferry, Lincoln.*

the 'Proceedings' of the Society of Antiquaries of Scotland as follows[2]:—

Ancient bone skate, $9\frac{1}{2}$ inches in length, one extremity being cut to a point. It was found, at a depth of 70 feet, in the parish of St Peter's, at Arches, Lincoln.

Another specimen, measuring 14 inches in length, pierced with a hole at each extremity. Found in 1848, at Stixwold Ferry, near Lincoln.

In the Museum at York there are a few skates exhibited which are thus referred to in the Handbook:—

Ancient skates, formed of the leg-bones of horses, polished on one side. They are frequently found in York, as at London and Lincoln, and were probably introduced into England by the Danes.

[1] Lincoln Vol., p. xxxii. [2] Vol. vi. p. 314.

Mr J. W. Bodger, Secretary of the Peterborough Scientific and Archæological Society, has kindly sent me a drawing of a bone skate (Fig. 104) found at Ramsey, Hunts, embedded 6 feet in peat.

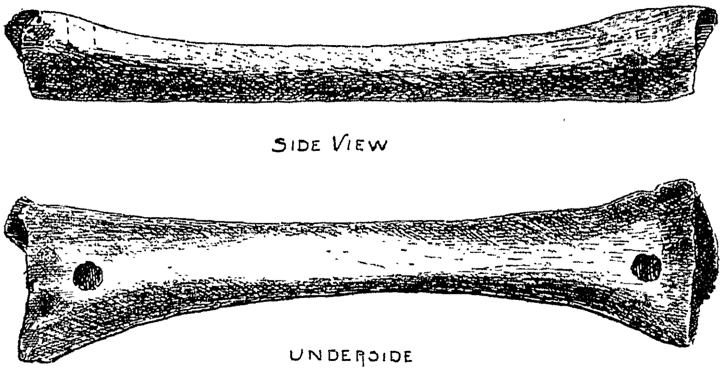


Fig. 104.—*Bone Skate found at Ramsey, Hunts.* (*After J. W. Bodger*) (½).

Antiquity of Bone Skates.

These are all the materials I have been able to collect on the subject, but I daresay they might be considerably increased by a more careful search among old documents and in local museums. I do not, however, think that any additional data so gleaned would materially alter the conclusions pointed at by the facts I have laid before you. The function of a skate assumes the existence of a climate capable of producing ice of sufficient strength and duration to afford scope for the practice of this mode of locomotion. Hence the climatal element would alone restrict their distribution, whether in past or present times, to the northern and colder regions of Europe. But the geographical area

of ancient bone skates, as revealed by the discoveries above recorded, seems to me to be more limited than that which climate alone demands. Thus in Britain they have been found only in a comparatively small district extending along the eastern shore-land from York to London. This is merely the western fringe of the area of their geographical distribution, which, as we have seen, embraced Holland, Denmark, the lower portions of Scandinavia, and North Germany. But before disposing of the significance of this point, it will be necessary to inquire into their distribution in time.

Probably the pastime of skating is more prevalent now than at any former period of the world's history, so that the discontinuance of bone skates does not mark the death of a custom, but merely the substitution of a more suitable material than the animal bones which had originally served for this mode of locomotion. Nor is there any exceptional interest attached to the gradual abandonment of these primitive skates more than to any other of the superseded implements of our common industries, such as querns, spindle-whorls, spinning-wheels, corn-hooks, &c. It is more especially at the other end of the chronological chain marked out by the appearance of bone skates on the field of European civilisation that their archæological interest lies. While their dying-out stage has lingered on in some quarters almost to the present day, the facts bearing on their origin, so far as hitherto correlated, leave the question, both as to time and locality, in the greatest doubt. Dr Lindenschmit, as already mentioned, includes them among prehistoric objects of the Stone Age. In support

of this view no less than four of the above recorded instances of discovery might be cited with some show of plausibility—viz., the grave-mound at Oosterend in Friesland, and the lake-dwellings of Kownatken, Starnberg, and Moosseedorf. The suggestion that the perforated bone found in a *Terramara* in Hungary was a skate rests on too slender a basis to be taken into account.

We will now examine *seriatim* the circumstances in which bone skates have been found in those four localities, with the view of showing that not one of them can be fairly accepted as a genuine product of the earlier civilisation with whose remains it had become associated.

We have no evidence that the bone skate figured by Lindenschmit came from a grave-mound at Oosterend except the bare statement. I do not, however, question the *bonâ fides* of this statement, either on the part of Dr Lindenschmit or of the discoverer of the object; but I cannot help thinking that the so-called *Grab-hügel* was nothing more than a *Terp-hügel*. At that time the nature of the *Terpen* was not known, and it is quite natural to suppose that an artificial accumulation of earth, containing a novel object of human workmanship, would be unhesitatingly considered as a burial-mound. Oosterend is situated a few miles south-west of Leeuwarden, in a district abounding with Terp-mounds. Such a locality, liable to be overrun with the tides prior to the construction of the great dykes which now hem back the ocean, was not likely to be selected by prehistoric man as a suitable place for the construction of a *Grab-hügel*.

The circumstances in which the other specimens mentioned by Lindenschmit were found are not stated, being apparently unknown, so that his Stone-Age theory of their origin is founded on one example reported merely on hearsay evidence to have come from a grave-mound. The observations made by Baron van Breugel Douglas, already quoted, would appear to have been based on Dr Lindenschmit's opinion.

The finding of bone skates on some of the lake-dwellings of North Germany is quite in keeping with the mediæval character generally assigned to these structures. Nor am I inclined to remove from this category the Kownatken lake-dwelling, notwithstanding that a few articles of the Stone Age were found on it. From this circumstance Professor Heydeck of Konigsberg thinks that the settlement should be relegated back to prehistoric times. But, on the other hand, Professor Virchow, who has paid great attention to the phenomena of *Pfahlbauten*, ascribes all the lacustrine structures in North Germany to a much later period than their analogues in Switzerland. "Ich denke," says he, "wir werden uns entschliessen müssen, ganz in Gegensatze zu den süddeutsch-schweizerischen Pfahlbauten, die Einführung der nördlichen Pfahlbauten an die Einwanderung des Slavo-lettischen Stammes anzuknüpfen."

In declining to accept the suggested prehistoric origin of the Kownatken settlement on the ground of finding a few relics of the Stone Age on it, we are supported by evidence derived from various collateral phenomena of an analogous character. A mixture of relics, apparently belonging to the earlier ages, is a

feature common to many of the lake-dwellings of Ireland and Scotland. We might with equal logical consistency argue that the Lochlee crannog was founded in the Stone Age, because among its relics were a stone axe and a flint scraper. But, in this case, such a conclusion would be absurd in face of the fact that in the same relic-bed, and almost in the very same spot where this stone axe lay, there was also an iron knife.[1] And, moreover, the very wooden structures which formed the foundations of the crannog, and consequently preceded the use of all the relics, bore unmistakable evidence of having been fashioned with iron tools.

In regard to the *Rosen Insel*, in the Lake of Starnberg, there can be no doubt that a pile-settlement of the Bronze Age flourished here, but, as already explained, the locality continued to be occupied by successive races up to the present time, so that in the absence of any positive evidence to show that the bone skate belonged to the earlier inhabitants, its discovery does not legitimately carry us back beyond the later period.

Only one other bone skate, labelled prehistoric, remains to be explained away—viz., that from the lake-dwelling at Moosseedorf. This settlement is one of the most typical of the Stone Age in Switzerland, and has yielded a large assortment of relics characteristic of that period, but none of the later ages, so that it appears to have come to an end prior to the Bronze Age. Moosseedorfsee was a small lake which became frozen

[1] See 'Ancient Scottish Lake-Dwellings,' p. 147.

over every winter, and thus afforded special facilities for skating. What, therefore, could be more probable than that, at any subsequent time, some person, enjoying the pastime of skating, would drop one of his skates over the site of the lake-dwelling? We must remember that after the destruction of the settlement not a vestige of its woodwork would remain above water to prevent such an occurrence at any time during the last two thousand years. The bone skate from Moosseedorfsee is thus not only an isolated and stray object among the lacustrine antiquities of Switzerland, but, so far as I know, nothing of the kind has ever been found in any station of the Stone or Bronze Age in Europe. Its presence among the relics of the primitive lake-dwellers at Moosseedorf seems pretty much on a par with the finding of an exploded gun-cartridge at the bottom of a prehistoric cairn.

General Conclusion.

From these facts and observations, I am of opinion that we have no trustworthy evidence in support of the theory that bone skates were ever used in prehistoric times in Europe. On the contrary, they appear to have been invented by the early Teutonic races who inhabited the shores of the Baltic, and to have been introduced into Britain by the early immigrants who hailed from these regions, possibly the superfluous inhabitants of the *Terpen.* As a corollary to this discussion, I may be allowed to direct attention to the importance to archæologists of being well acquainted

with the special characteristics of any well-marked civilisation. If this conclusion as to the origin and distribution of bone skates be well founded, their discovery in a pile-structure in London, notwithstanding that they were associated with objects undoubtedly emanating from Roman sources, may have a determinative significance on the nature of these remains not hitherto sufficiently recognised.

Appendix.

Since writing these notes I have had an opportunity of seeing a few more bone skates. In the Naturhistorisches Museum, Vienna, there are five or six examples from Bohemia. Two of these were found associated with objects which, in the opinion of Dr Moriz Hoernes, might be regarded as bordering on prehistoric times. The others have a more recent appearance, and are probably products of mediæval times. In the National Museum at Buda-Pesth are several metacarpal bones of the horse or ass, shaped and perforated like bone skates, but none of these objects presents a polished surface, and it is possible that they may have been used for a different purpose. One specimen in the Joanneum Museum at Graz is clearly of recent origin, but it has no history.

The ethnographical collection at Helsingfors contains a number of bone skates having generally two small holes at the side for fixing them on the feet.

I have also observed one or two specimens in almost every museum in North Germany which I have visited.

In the Museum für Völkerkunde, Berlin, there are four, all made of the shank bones of the horse and labelled Potsdam; also one, a very large specimen, with an upright perforation at one end, from the district of Teltow.

Dr Conwentz, director of the Provinzial Museum at Danzig, informs me that there is one bone skate in the archæological department of that museum. The relic was found in the bed of the river Motlau, within the town, and is in a very good state of preservation.

In the Archæological Museum of Stettin I noted four specimens said to be of Slavish origin. There is also one in the Stralsund Museum, and not fewer than a dozen in that of Kiel. Fräulein Mestorf informed me that the latter were found on the sites of neighbouring *Burgwälle*.

These additional notes on the geographical distribution of bone skates are of no special value beyond strengthening the evidence on which the general conclusions already stated were based.

CHAPTER VIII.

PREHISTORIC SAWS AND SICKLES.

I. Notes on Flint Saws and Sickles.—Double-handed Saws of Polada—Egyptian Sickles with Flint Teeth—Other compound Implements and Weapons—Variety and Distribution of Flint Saws—Saws *versus* Sickle-teeth.

II. Notes on Metallic Saws and Sickles.—The Transition into the Bronze Age—A Copper Age in Europe—Bronze Saws and their Distribution—Bronze Sickles and their Distribution—Saws and Sickles of the Early Iron Age—General Remarks—Summary.

I. Notes on Flint Saws and Sickles.[1]

For many years after the astounding revelations of lacustrine researches had shed a flood of light on the prehistoric civilisations of Europe, there was no surmise that the flints with serrated edges, which are so abundantly scattered over the country, had been used in any other capacity than as simple implements for sawing. This view, indeed, had been rather confirmed by the fact that many of them were found fixed in a horn or wooden handle. The discovery, however, in

[1] A paper read before the Anthropological Section of the British Association for the Advancement of Science, at Nottingham, September 1893; and subsequently published in the 'Illustrated Archæologist,' vol. i. pp. 176-193.

the Polada lake-dwelling, near Desenzano, of a wooden casing containing four serrated flints fixed in a groove along one of its margins by means of a resinous substance, has given a new direction to the inquiry as to the manner in which these so-called saws had been used.

Double-handed Saws at Polada.

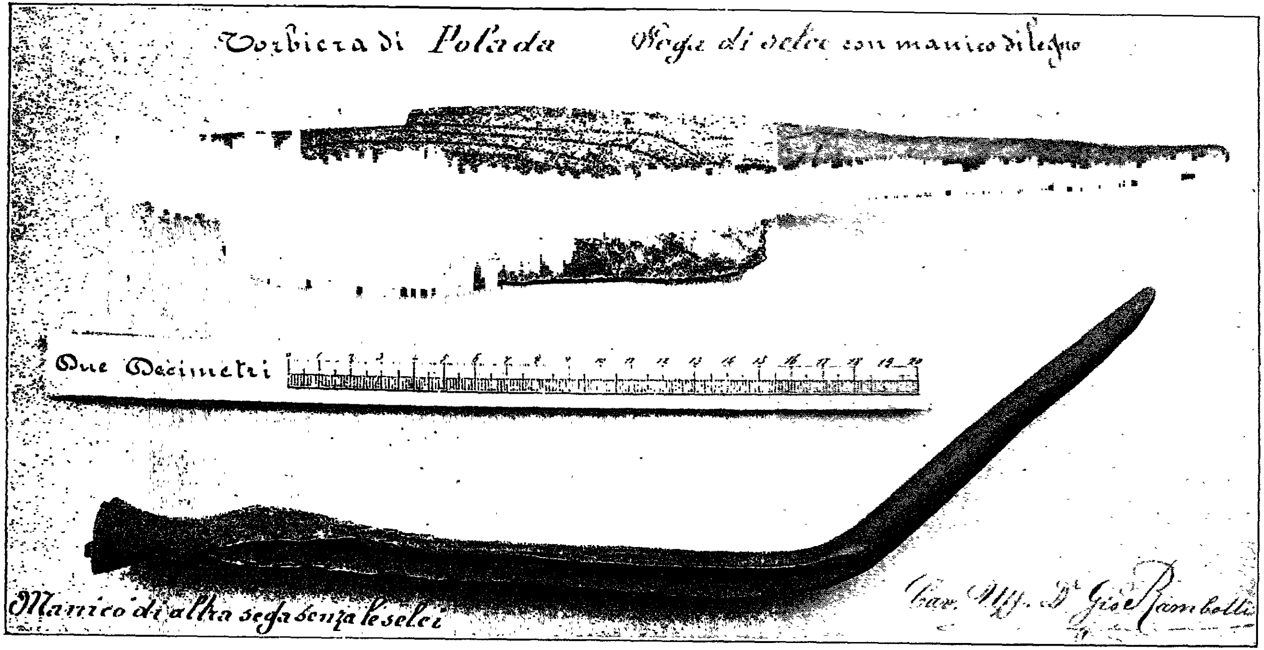
This implement (Pl. VI.) was formed out of one solid piece of wood, about 16 inches long, with a flattened body terminating at one extremity in a horn-like projection 6½ inches long, and at the other in a button-shaped protuberance resting on a round stem 1¼ inch long. The pointed extremity is not continued in the same plane as the body, but curves, somewhat abruptly, to one side, at an angle of about forty degrees, immediately after clearing the last flint. The other end of the implement is totally different. Its widest part is the terminal disc of the protuberance, from which projects a slender perforated ledge left in the solid. As a handle, this end afforded a good grip for the thumb and two forefingers, and the little perforation at the end enabled the owner to carry the implement on his person suspended by a string.

These structural details will be readily seen by a glance at the photograph here reproduced (Pl. VI.), which shows two implements of the same character. The upper one is absolutely perfect, and still retains its full complement of flints, but the other is merely the wooden casing, turned a quarter of a circle towards the former so as to exhibit the marginal groove and the

bend of the horn-like handle. Both these casings (to which I may add a third found in the same place, and also without flints) are so exactly similar in form, size, and general structure, that one cannot help thinking they were all made by the same workman, or at least after a common pattern. One of the two casings *minus* the flints was picked up by a little girl, who stated that when she found it there were flints in it, but that they afterwards dropped out. But, without this evidence, there can be no difficulty in coming to the conclusion that the empty grooves were intended for flints, and that, in fact, originally, both these casings had been implements precisely similar to the perfect specimen. The four flints still *in situ* in the latter are serrated along their free or cutting edge, and so arranged as to bring all the cutting edges into a straight line. Let the abruptness with which the line of flints terminates at both ends also be specially noted.

There can, in my opinion, be no doubt whatever that this unique implement was a double-handed saw. Its present owner, Dr Rambotti, President of the College at Desenzano, had a favourite theory that the lake-dwellers who used it were a left-handed race, because the angular position of the horn-like handle forced the manipulator to hold the other end in the left hand, as seen in Pl. VII.,—a remark that applies to the other casings as well.

The Polada lake-dwelling has yielded a large assortment of industrial remains, and, being all kept together at the private residence of Dr Rambotti, they form one of the most instructive collections in Italy. The flint



DOUBLE-HANDED FLINT SAWS FROM POLADA LAKE-DWELLING.

PLATE VI.

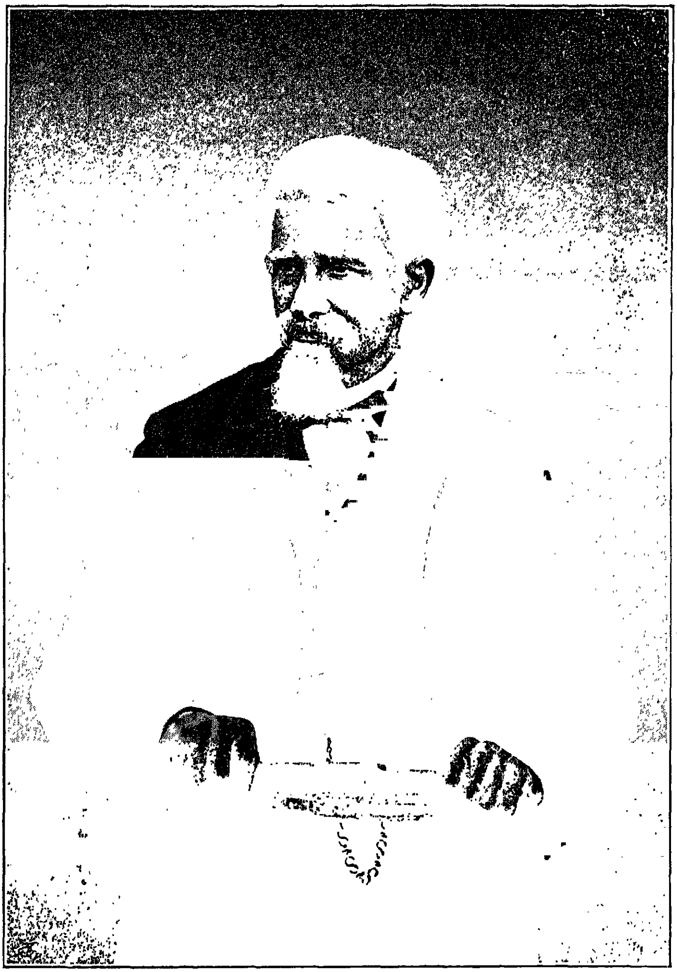


PLATE VII.

DR RAMBOTTI HOLDING THE DOUBLE-HANDED SAW FROM POLADA.

objects are of special interest, both on account of their number and fine workmanship. Arrow- and lance-heads, of all forms and sizes, exceed 300 in number; and isolated saws—*i.e.*, free from any casing—amount to nearly 100. One of the latter is notable by having the teeth on one side formed in slanting grooves, like those of a modern cross-cut saw. The character of the relics, as a whole, shows that the station belonged to the period of transition, just when the Stone-Age civilisation commenced to be influenced by the introduction of a few bronze objects.

Notwithstanding that this valuable collection has been in the possession of Dr Rambotti since 1875, no account of it has yet been published, with the exception of the notice which appeared in my recent work on 'The Lake-Dwellings of Europe.'

Egyptian Sickles with Flint Teeth.

While the proof-sheets of the description of the Polada lake-dwelling were still in my hands, I happened to visit a collection of Egyptian antiquities exhibited by Dr Flinders Petrie in London, in the autumn of 1889. Among them was a corn-sickle constructed on precisely the same principles as the Polada double-handed saw, and to the striking similarity of their construction I drew attention in a footnote, as follows:—

While visiting Mr Flinders Petrie's collection of antiquities from Egypt, lately exhibited in London, I was much interested in seeing a well-shaped wooden sickle, with a groove in which a flint saw was still cemented in its place. The wooden portion

of this unique instrument is shaped like a modern corn-hook, with the exception that the handle turns downwards at a right angle to the cutting plane, and the opposite end runs out into a long sharp point. It measures 12½ inches from tip to tip, and 17 inches from the point to the most bulging part of the body. From the same place were various other flint implements, and some semilunar knives or saws, precisely similar to those so common in the Scandinavian archæological area. Mr Petrie also pointed out some flint objects which were undoubtedly an

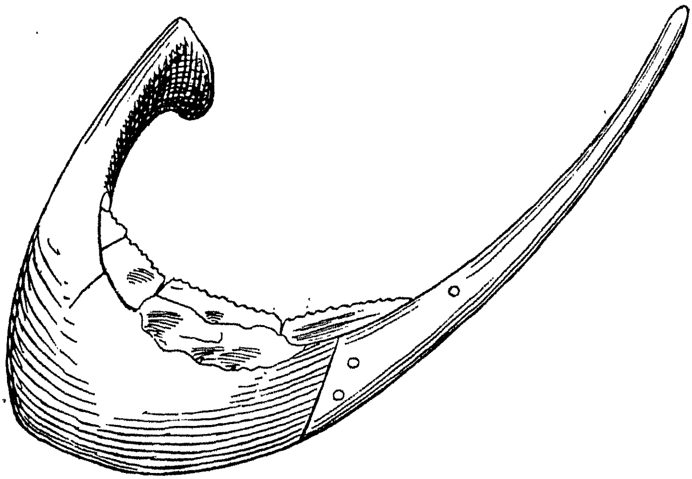


Fig. 105.—*Egyptian Sickle from Kahun; Twelfth Dynasty; upper side.* (*From a photograph by F. C. J. Spurrell, Esq.*)

imitation of implements of copper and bronze with which they were associated. The tombs of Hawara, in which these relics were discovered, are said to be of the Twelfth Dynasty, dating some 2600 years B.C.[1]

In the following year, and in the same place, Dr Petrie exhibited another large assortment of industrial remains, from Kahun in Egypt, among which were two other sickles, almost identical with the one from Hawara.

[1] The Lake-Dwellings of Europe, p. 502.

Subsequently, Mr F. C. J. Spurrell published an elaborate article on these Egyptian sickles, entitled "Notes on Early Sickles,"[1] in which he directed attention to the Polada implement, as figured by me,[2] and argued that it was a sickle and not a saw, as I had asserted. In this paper the author gives photographic illustrations of the two sickles from Kahun, together

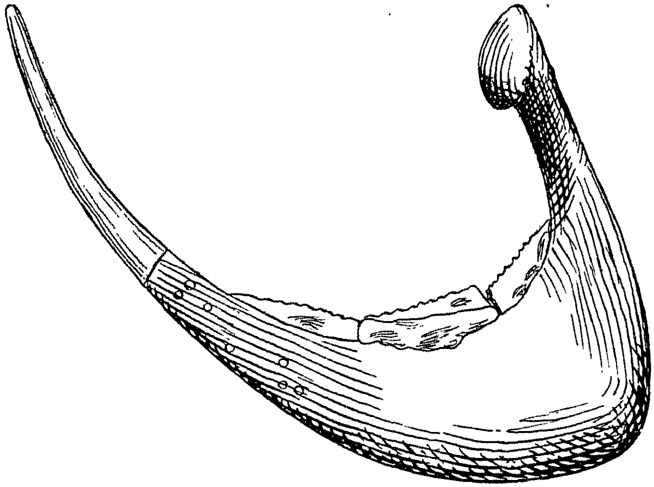


Fig. 106.—*Egyptian Sickle from Kahun; Twelfth Dynasty; lower side. (From a photograph by F. C. J. Spurrell, Esq.)*

with an interesting description of the development of the sickle, and of the various forms it had assumed in proto-historic and early historic times. With regard to their structure he thus writes:—

This sickle [dating from the Twelth Dynasty], of which a figure is given (Figs. 105 and 106), is of acacia wood, dark and hard; it was a single piece originally, and apparently grown in

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[1] Archæological Journal, vol. xlix. p. 53.

[2] Lake-Dwellings of Europe, Fig. 67, No. 12.

a forced curve, with a view to the manufacture of the sickle. . . . The groove, which does not exceed half-an-inch in depth, was cut by metal chisels, copper being in general use at the time. The artificial teeth were set in this groove in a cement of clay, black Nile mud mixed with gum. The teeth are partly buried in this groove, the cement is smeared over the junction of the teeth and the jaw, overlapping the teeth about a quarter of an inch, and leaving about the same distance projecting free. These measures are for the centre of the saw; towards the point the proportions are reduced, at the near end they are increased. The tooth (only one being *in situ* when the implement was found) is a thin flint flake, notched at the exposed edge.

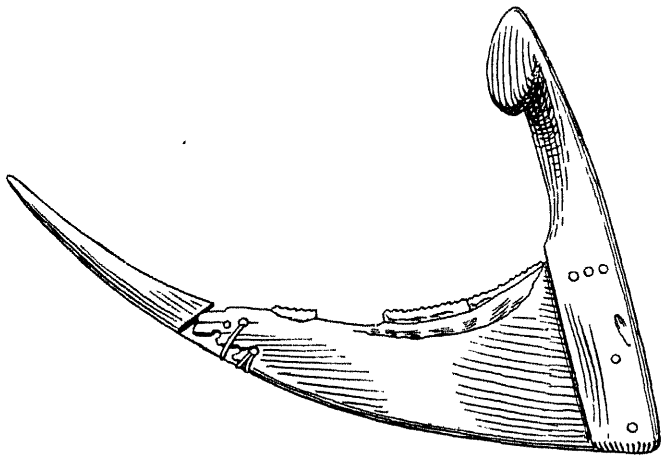

Fig. 107.—*Egyptian Sickle from Kahun; Seventeenth Dynasty; lower side.* (*From a photograph by F. C. J. Spurrell, Esq.*)

The teeth are more or less regularly notched or serrated; occasionally some are found which can scarcely be said to be more than jagged. They vary in length from half an inch to 4 inches, the average being one inch and a half. Some of the serrations are close together, and very finely executed; others are nearly a quarter of an inch apart. The last flake in the angle was always modified in form, and was usually thicker and stronger than the others. Large numbers of these sickle-teeth

are found in Egypt, especially when excavations are made in the older agricultural districts. They differ very little in general form from the earliest known date up to Roman times, except that the later ones are more clumsy in shape and trimming. Most of the teeth which are obtained in excavations, as well as those still in the sickles, are very much polished along the edge left free to cut with, and this bright line is usually distinctly marked at its lower edge up to which the cement extended.

From the above descriptive details it will be seen that the Egyptian sickles are differentiated from the Polada saws in the following respects:—

1. The cutting edge in the sickle is curved to correspond with the shape of the body of the wooden casing. In the saw this line is straight.

2. The terminal flints in the former shelve into the wood so as to bring the inner side of the gathering point, and of the portion of the implement next the handle, into a continued line with the cutting edge. In the latter the cutting edge terminates abruptly at both ends.

3. The gathering point of the sickle is in the same plane as the body, whereas the pointed extremity of the saws (between which and the former Mr Spurrell sees an analogy) is bent sideways at a considerable angle.

The only material point on which I differed from Mr Spurrell was that of classifying the Polada instrument among the sickles. As this point is of considerable archæological importance I made a polemic reply,[1] stoutly defending the accuracy of my own description and opinion.

Since the publication of these papers I have not looked further into the merits of this controversy, nor

[1] Archæological Journal, vol. xlix. p. 164.

would I again have recurred to it had it not been for the receipt, recently, of the photograph which exhibits the true characters of the Polada objects more faithfully than it was possible by a drawing. It seems that the question at issue interested Dr Rambotti so much, that he got these photographs specially taken in defence of his and my opinion. Next to an actual inspection of the objects, a photograph supplies the best evidence in a question of this kind that can be produced; and with its exhibition I leave the matter in the hands of competent critics.

Other compound Flint Implements.

That the art of manufacturing compound implements and weapons by the insertion of flints into casings was not confined to Lombardy, but extended widely among the prehistoric people of Europe, there is some evidence to show. On this point I will first notice a strange-looking object (Fig. 108) found on the site of a lake-dwelling at Vinelz, in Switzerland. This station, which first came under the notice of archæologists in 1881, is the most typical of the period of transition (*Uebergangszeit*) which has yet been carefully examined. The relics, generally, are characteristic of the later Stone Age, and among them are no less than 100 rudely made objects of copper (but none of bronze or iron), consisting of beads, axes, chisels, knives, &c. Hence this lake-dwelling is frequently referred to by the advocates of a Copper Age in Europe as furnishing irrefragable evidence in support of their theory.

But the special object which now concerns us is a piece of wood, about 9 inches long, which originally contained three worked flints, like conical teeth, inserted in a row along one side of it. These flints were separated from each other by an interval of rather more than half an inch, and their tips projected above the wood about three-eighths of an inch. This singular relic is now preserved in the Cantonal Museum at Berne, under the custody of Dr von Fellenberg, its discoverer. In 1883, shortly after its discovery, it was figured and described by Dr Gross in his 'Protohelvètes,' (Fig. 4, p. 15); and in 1888 by Heierli in the ninth report of the 'Pfahlbauten' (Pl. xvii. Fig. 3, and p. 38). Also in 'The Lake-Dwellings of Europe,' (Fig. 185, No. 17, pp. 34 and 504).

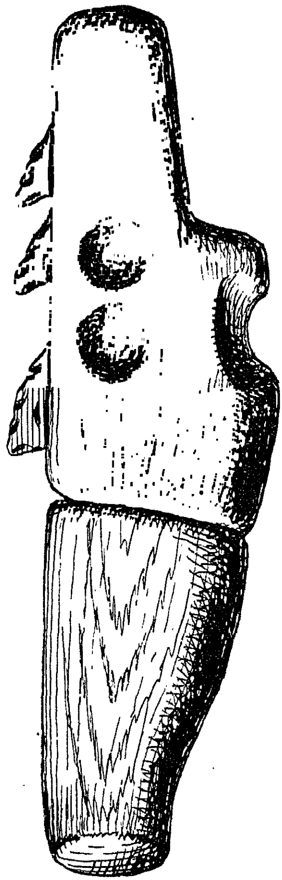

Fig. 108.—*Flint Saw from Lake-Dwelling at Vinelz.*

Dr Gross thus describes it :—

Les nombreux éclats pointus auxquel nous donnons le nom de flèches n'ont pas tous servi à cet usage; car M. de Fellenberg a découvert tout récemment à Fenil (Vinelz) un curieux instrument formé d'une pièce de bois, recourbée en crochet à l'un des bouts et munie d'un côté de petites excavations dans

lesquelles sont fixés, avec de la résine, plusieurs de ces éclats de silex pointus. Pour faciliter le maniement de cet outil, qui probablement était utilisé comme scie, on a ménagé près de la poignée, deux dépressions arrondies pour y placer les doigts.

Mr Heierli also designates it a hand-saw :—

Eine Handsäge, bestehend aus einem hölzernen Schaft mit einer Rinne, worin in Erdpach 3 Feuersteinspitzen stecken, deren 2 noch feststehen. Zum Einsetzen zweier Finger bei der Handhabung des Geräthes sind auf der Seite desselben 2 Eindümpfungen angebracht.

Mr Spurrell, however, claims this object as a portion of a sickle analogous to the Egyptian ones ; but, for my own part, I do not see very clearly how it could be used either as a saw or a sickle, as the teeth are so widely set that the mechanical operation of sawing, or of cutting corn, would be almost impossible. It, however, establishes on a wider basis the application of the

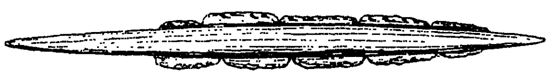

Fig. 109.—*Flint Spear-head in the Stockholm Museum.*

principle of combining flints in casings for the purpose of making tools or weapons. A similar conclusion may be drawn from another class of objects found in Scandinavia, several of which are to be seen in the Museums of Copenhagen and Stockholm, and elsewhere. They are sometimes described as spear- and sometimes as arrow-heads. The one here represented (Fig. 109) is after a drawing in Dr Montelius's guide to the collection of antiquities in the National Museum in Stockholm, where it is described as "a bone arrow-head with a

narrow and deep groove along each edge in which thin flint-flakes are fastened with a kind of resin: traces also are visible of the resin with which the head was fastened to the shaft." This object is 5½ inches long, and contains five flakes on each side. These flakes have very sharp edges, and the weapon, whether used as an arrow or a spear, must have caused a wound of a fearfully lacerating character on the unfortunate victim. Sir John Evans describes a curious knife in the Berlin Museum, constructed on similar principles.[1]

Variety and Distribution of Saws and Sickles.

Although my previous reply to Mr Spurrell was necessarily of a controversial character, I found occasion to make some general remarks on early saws and sickles, which, being still applicable, I may be permitted to quote:—

The specialisation of the saw as a separate tool from the knife, both of which were originally one and the same, must be dated far back in prehistoric times, for we find saws among the relics of the Reindeer period in France, the *Kjökken-möddings* of Denmark, and other remains of a pre-neolithic character. During the neolithic civilisation in Europe the use of saws, mostly made of flint, was general; and implements so widely distributed both in space and time must have undergone certain modifications dependent on the social exigencies or fancies of the various peoples who used them. Hence, like all other stone implements, some forms of saws are recognised by archæologists to be peculiar to certain geographical or archæological districts, as for example the well-known semilunar types of Scandinavia. The abundance of the so-called flint saws during the Stone Age

[1] Ancient Stone Implements, p. 264.

in Europe, contrasted with the rarity of this implement when made of bronze in the succeeding age, has attracted considerable attention. Of bronze saws, only some half-a-dozen examples have been collected among the remains of the lake-dwellings. This apparent falling off in their numbers I have endeavoured to account for partly by the large number of sharp-cutting instruments which suddenly appeared as a consequence of the knowledge and use of the metals, and were better adapted for many of the purposes to which the saws were formerly put, such as the making of arrow-stems, wooden handles, &c. On the other hand, it is to be observed that the relative frequency of the sickles is reversed in these two ages. In the Bronze Age, next to the celts or axes, sickles are amongst the most common objects found on the sites of lake-dwellings, as well as among hoards and other sources of antiquities; whereas in the Stone Age there is scarcely any object known that goes under the name of a sickle. But there must have been sickles in the Stone Age as well as in the Bronze Age. The cultivation of corn was not confined to the latter, as we find agricultural implements, and even various kinds of grain, among the *débris* of the earliest neolithic stations. What, therefore, it may be asked, was the form and character of the implement which in the Stone Age supplied the function of the bronze sickle? Sir John Evans has offered some suggestions on this problem? In his 'Ancient Stone Implements' he has figured three curved flints (Figs. 268-270), which he is inclined to think "may not impossibly have supplied the place of sickles or reaping-hooks, whether for cutting grass to serve as provender or bedding, or for removing ears of corn from the straw. . . . The analogy in form between these flint blades and those of the bronze reaping-hooks occasionally found in Britain is striking, when we leave the sockets by which the latter were secured to their handles out of view. These also have usually the outer edge sharp as well as the inner, but for what purpose I cannot say" (p. 320). But with the knowledge now supplied by these recent discoveries we may go a step further, and at least surmise that compound sickles like the Egyptian ones might have been in use during the Stone Age period in Europe. As a bearing on this argument

it matters little whether the Polada implements be sickles or saws. They establish the important fact that the method of combining flints by fitting them up in a wooden casing was known and practised by the neolithic people of Lombardy. It is not therefore an improbable hypothesis that some of the so-called flint saws, now and then picked up on the fields, may have been the teeth of sickles lost or worn out and thrown away during the operation of harvesting. That none of these casings have as yet come to light is no doubt a regrettable missing link. When, however, we think of the imperfection of the archæological record, especially as regards the wooden relics of these early ages, owing to the liability of wood to decay, and that, indeed, it is only under exceptional circumstances that any of them have come down to the present time, the absence of such casings for sickles need not cause astonishment. The handles of bronze sickles, notwithstanding that their numbers are known to have been very great, are so extremely rare that only one or two specimens have come to light. Before lacustrine researches revealed the rich materials left by the long-forgotten lake-dwellers, where could we point to a practical demonstration of the various methods of hafting the stone and bronze axes which have been collected in thousands all over Europe?[1]

On the assumption that implements, analogous to the Egyptian sickles and the Polada saws, were common in prehistoric times, it is probable that of the large majority of them nothing would be now extant except the eliminated flints, which of course would fall to be classified in the category of saws. Hence the question now to be investigated resolves itself into a careful study of these so-called saws, with the view of determining from their form, peculiarity of structure, or usage markings, in what capacity they had been formerly used.

[1] Archæological Journal, vol. xlix. p. 174.

In pursuing the investigation on these lines, the first thing is to define accurately the essential characters of a flint saw. In the earlier reports of Stone-Age relics the term is somewhat loosely used to designate knife-flakes accidentally chipped. Again, a worked flint-knife—*i.e.*, one with secondary trimming along its margin—has its cutting edge of necessity uneven, and hence it also is sometimes confounded with the saws. The special characteristic of a saw is an edge with teeth so regularly formed as to indicate that they were intentionally made for the purpose of cutting by means of a to-and-fro motion (Fig. 110). An implement so manufactured, whatever the size of the teeth may be, must be regarded as a saw, unless the teeth are proved to have some other special function, such as those on both edges of some of the spear- and arrow-heads in Scandinavia. Nor must we confound with the saws some flint-flakes, with artificially formed gaps along their edge, which may have been used for scraping wood, such as in making the shaft of an arrow.

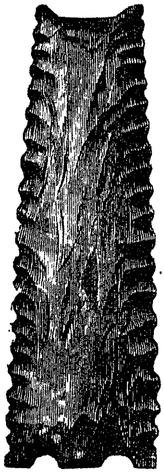

Fig. 110.—*Flint Saw from Sweden* (½).

According to the above definition saws have been manufactured by the inhabitants of the Reindeer Caves of France, some of which may be seen illustrated on Pl. xli. of 'Reliquiæ Aquitanicæ.' One of these, No. 10, from La Madelaine, is thus described: "Part of a narrow flake of white calcedonic flint, worn down on one side as a side-scraper, and dressed as a saw

on the other. It retains thirteen notches, and is broken through the fourteenth." It is 43 millimetres long, 6 broad, and 3 deep. Flakes carefully serrated at the edges have also been found among the *debris* of the Danish *Kjökken-möddings*, one of which is illustrated by Madsen.[1]

Of the numerous examples of saws recorded from the sites of the lake-dwellings of Central Europe, there can be no doubt that some so designated are merely knife-flakes mounted in handles. Others, however, must, with equal certainty, be regarded as true saws. Dr Gross recognises this source of confusion, and, in his own descriptions of lake-dwelling remains, carefully distinguishes between the saw and the knife. Hence in 'Protohelvètes,' Plate v., the following objects are thus described: No. 1, "scie montée dans une poignée de bois"; No. 13, "scie à dents large (rare)"; Nos. 25 and 26, "couteaux avec poignée en bois d'if"; No. 38, "scie en forme d'amande"; No. 39, "grande scie"; and No. 41, "couteau scie."

Similar distinctions are observed by other writers throughout Keller's reports of the 'Pfahlbauten.' Dr Lachmann, in his description of the antiquities found at Nussdorf (sixth Report), writes thus: "Besonders zierlich gearbeitete Exemplare sind fünf länglich-ovale Sägeplatten, welche eine Länge von 3″ bis 4″ und eine Breite von 0·75″ bis 1″ haben (Taf. vi. 14). Ein einziges Stück hat die Gestalt eines fast regelmässigen Rechteckes mit scharfen Ecken, ganz ebenen glatten Flächen und nur einer gezahnten Längenkante" (Taf.

[1] Afbildninger, Pl. i. 15.

vi. 20). The writer then goes on to describe two other flint saws in handles, and portion of a semilunar knife or saw, found at Bodmann, similar to those from Scandinavia (Taf. vii. 9, 10, and 32). Further examples of flint saws, still in their original handles, are figured in the seventh Report, Pl. i. 4, Pl. xxi. 4 and 5, and in the eighth Report, Pl. ii. 12, and Pl. vii. 20.

A flint saw of the Scandinavian type, from Holstein, is figured in 'Horæ Ferales' (Pl. ii. Fig. 35); and others of the same type from Schussenried, the Mondsee, and parts of the Danubian basin, are figured in the 'Lake-Dwellings of Europe' (Fig. 34, No. 20, and Fig. 38, Nos. 2, 3, and 4). Throughout this work will be found numerous illustrations of flint saws, from various stations, among which is one from the Isola Virginia, in Lake Varese (Fig. 48, No. 2). One from Bodmann, remarkable in having a handle supposed to be made of reindeer-horn (Fig. 30, No. 17), is here reproduced as Fig. 111.

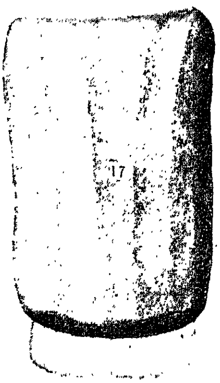

Fig. 111.—*Flint Saw in horn handle from Bodmann* (½).

In 'Musée Préhistorique' over a dozen flint saws, with and without handles, culled from various localities in Western Europe, are figured on Pls. xxxv.-xxxvi. M. Gabriel de Mortillet names several localities in the valleys of the Seine, Loire, and Rhone, which have yielded saws; and in one place, called l'Epargne (Indre et Loire), he states that there had been a fac-

tory for the making of a special type, "scie à coches latérales," said to be peculiar to France.[1]

Sir John Evans has engraved three flint saws from his private collection which had been procured from the Yorkshire Wolds. They are thus described :—

The largest (Fig. 199) has been serrated on both edges, but has had the teeth much broken and worn away on the thinner edge. Fig. 200 is very minutely toothed on both edges, and has a line of brilliant polish on each margin of its flat surface, showing the friction the saw has undergone in use, not improbably in sawing bone or horn. Fig. 201 is more coarsely serrated, and shows less of the characteristic polish which is observed on so large a proportion of these flint saws. The teeth are in many so minute that without careful examination they may be overlooked. Others, however, are coarsely toothed.[2]

The same careful observer has also directed attention to another example (Fig. 202) having the teeth at one end of the flake. It was found in a barrow at West Cramore, Somerset, associated with numerous flakes and scrapers; and it may be noted that in the same barrow a bronze dagger was found. Another specimen, found in an old pit at Brighthampton, Oxon., has been engraved in the 'Proceedings of the Society of Antiquaries.'[3]

Canon Greenwell has engraved a flint knife,[4] in regard to which he says :—

By far the most beautiful specimen I have yet met with; it is very delicately flaked over the whole of the convex surface, the edges being serrated with the greatest skill and regu-

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1 Le Préhistorique, p. 512.
2 Ancient Stone Implements, &c., pp. 265, 266.
3 Vol. iv. p. 233.
4 British Barrows, Fig. 129, p. 285.

larity. It is another example of those implements which, when associated with interments after cremation, have been usually found to be themselves unburnt.

With regard to the contents of another barrow in the parish of Rudstone, he writes as follows:—

> Amongst the implements must be numbered seventy-nine saws; seventeen scrapers; three leaf-shaped arrow-points; two pointed tools (probably for boring); several flint articles of uncertain purpose; a hammer-stone; and a piece of a green-stone axe. Many of the saws are very delicately serrated, some along both edges, and showing by the glaze upon the edge that they had been in use. The number of saws was very surprising, and far exceeded the aggregate of those obtained from all the barrows I have opened; and it is by no means easy to give any reasonable explanation of the phenomenon.[1]

Other localities in England from which flint saws have been recorded are barrows, as well as the surface, near Bridlington;[2] a long chambered barrow at West Kennet, Wilts;[3] the downs, near Newhaven, Sussex;[4] Liffs Low, near Biggen.[5]

Dr Joseph Anderson has recently directed my attention to the large number of flint saws in the Scottish National Museum, collected chiefly on the sites of the blown sands at Glenluce, Culbin, and Golspie. The number catalogued up to date is as follows: Glenluce, 100; Culbin, 37; Golspie, 8; other localities, 15: a total of 160.

[1] British Barrows, p. 292.

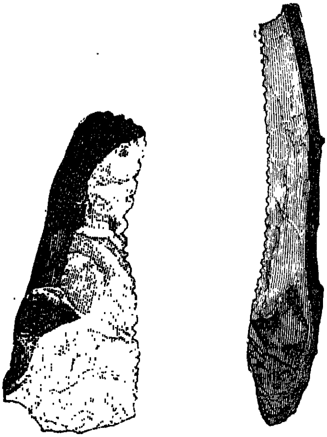
[2] Archæologia, vol. xxvii. p. 74.

[3] Ibid., vol. xxxviii. p. 417.

[4] Ancient Stone Implements, &c., p. 266.

[5] Vestiges of the Antiquities of Derbyshire, p. 43. A neat flint saw was found during the exploration of the Calf Hole Cave, near Skipton ('Brit. Association Report,' 1894, p. 273). A specimen is also reported from the Lake-Village of Glastonbury (ibid., 1895, p. 520).

These implements are usually made of flakes, but sometimes of chips, carefully trimmed to a series of regularly serrated teeth. Some are triangular on section, and only one of the edges is serrated. Others, again, are serrated on both edges. The teeth are in most instances minute, and made with great care.



Figs. 112, 113.—*Flint Saws from Glenluce, Scotland* (1/1).

Figs. 114, 115.—*Flint Saws from Culbin Sands, Scotland* (1/1).

Along the edge of one specimen from Glenluce—a long, narrow, thickish flake, and serrated on both edges—Dr Anderson counted thirty-five teeth in a length of 1¾ inch, and along this edge there was to be seen a narrow band of glistening polish, scarcely deeper than the teeth. This feature has been observed on many of these saws. Five examples (Figs. 112 to 116) of the Scottish saws have been engraved in the 'Proceedings of the Society of Antiquaries of Scotland.'[1]

Formerly, somehow, it was a current opinion amongst

[1] Vol. xi. p. 584, and vol. xxv. p. 497.

archæologists that flint saws were not found in Ireland. That this opinion is erroneous is clearly proved by Mr Knowles, who writes to me that he possesses numerous examples of genuine saws, some of which he picked up among the *débris* of kitchen-middens on the sandhills of Ireland. He states that in addition to flakes "so serrated at the edge that a person at once comes to the conclusion that they had been prepared for use as saws," there is another class of implements largely found in Ireland called "hollow scrapers," many of which must undoubtedly be regarded as true saws, as the teeth are regular and well defined. This is the case with two specimens (Figs. 117 and 118) which Mr Knowles has kindly forwarded to me, both showing a line of glistening glaze near the edge.[1] One of them has a neatly worked edge in the form of a semicircle of almost mathematical precision, and rather less than an inch in diameter.

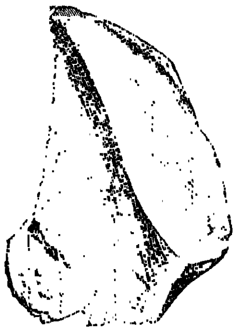


Fig. 116.—*Flint Saw from Glenluce, Scotland.*

These finely toothed saws have not often been found outside the British Isles. Indeed at this moment only one exception to this limitation of their distribution occurs to me—viz., a small specimen found near Eggburg, Lower Austria. It is figured and described by

[1] Among a number of flint implements from County Antrim exhibited by Mr Knowles at the Loan Collection of the British Association for the Advancement of Science, Liverpool Meeting, 1896, were twelve of these hollow circular saws.

Dr Much [1] as having exceptionally fine teeth, in marked contrast to another flint saw with very coarse teeth.[2] It is rather remarkable, as will be afterwards seen when we come to follow up the evolutionary changes imposed on these implements in consequence of the introduction

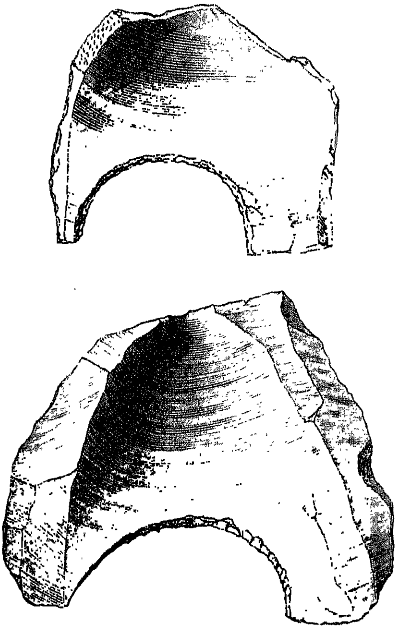


Fig. 117.—*Two Circular Flint Saws from Ireland* (1/1).

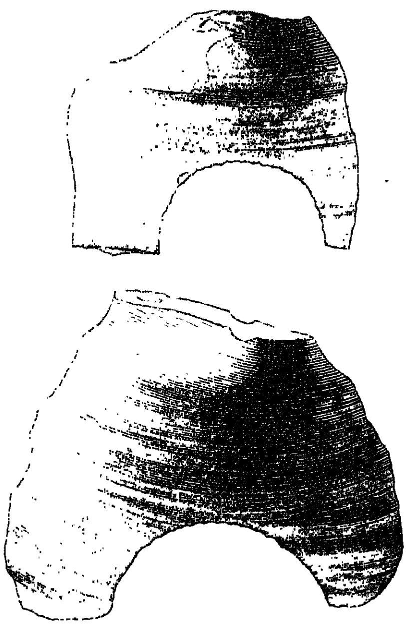


Fig. 118.—*Other side of Saws in Fig.* 117.

of bronze into the industries of the period, that bronze saws have never yet been found in the British Isles. The probability, therefore, is that these finely toothed implements belong to the Bronze Age, and that they were used for metallurgical purposes; nor can it be questioned that they would be well adapted for man-

[1] Kunsthistorischer Atlas, Pl. ix. Fig. 12. [2] Ibid., Fig. 14.

ipulating small portions of gold, silver, or bronze in the manufacture of ornaments.

Saws versus *Sickle-teeth.*

Reverting now for a moment to the so-called saws recorded as having been found in Egypt, all of which are claimed by Mr Spurrell as sickle-teeth.

> Formerly [he writes], these teeth were called indiscriminately *saws*, and in museums are so labelled now. Passalacqua[1] and Pettigrew[2] claim such instruments as amongst the implements employed in mummifying. This is altogether a mistake, as the saw or saws they speak of were merely included amongst the small objects belonging to the person buried, and were deposited with the mummy in a parcel containing a palette and other things. A similar collection of miscellaneous objects in a little bag was found by Mr Petrie in a Kahun dwelling, also including flint flakes and sickle-teeth.[3] Sickle-teeth are figured by Lepsius as saws,[4] and by F. Mook[5] and Jukes-Browne;[6] also by E. Lartet,[7] and others already mentioned.—(*Loc. cit.*)

This sweeping generalisation Mr Spurrell applies to the flint saws found by Schliemann at Hissarlik, by Flinders Petrie at Lachish in Syria, and by Canon Greenwell in the British barrows, as well as to those described by Sir John Evans from various parts of England. In support of his opinion he discusses the peculiarities of the structure of sickle-teeth, and a special polish, seen on many of them, which he thinks could only have been caused by the friction of ripe

[1] Cat. Rais.
[2] Mummies, Pl. iv.
[3] Petrie, Kahun, p. 13.
[4] Zeitschrift für Egypt: Sprache, 1870.
[5] Aegyptens vormetallische Zeit, 1880.
[6] Journal Anthrop. Institute, vol. vii.
[7] La Mer morte.

straw. Among the sickle-teeth, besides the irregularly serrated flakes similar to those actually found in their casings, he includes a number of very differently constructed saws, and accounts for their peculiar forms by some curious speculations. Thus, a flake serrated on both sides he considers a sickle-tooth which could be reversed by the reaper when the one edge became blunted. "The teeth," he observes, "fell out in the act of using, as well as wore out by smoothing down. These had to be replaced, nor could the sickle be used with a gap in the row. Sometimes the old teeth were merely reversed in the groove after serration; indeed, in anticipation of such an accident, teeth have been inserted already serrated at both edges." We are thus apparently asked to believe that a flint flake, nearly the whole of which was embedded in hardened cement, could be there and then readily reversed without loss of time.

The following remarks are ingenious, but before accepting them as an explanation of the phenomena in question, we should require more positive evidence that such a sickle had been ever used:—

There have been found occasionally in Egypt some very large flint flakes, bearing the distinct signs of employment in sickles, such as careful serration, adaptation at the ends for fitting with others, the characteristic shape of the rearmost one, the brilliant polish, and occasionally the marks of still adherent gummy clay. But the depth at which they must have been inserted in the jaw precludes the supposition that they belonged to the light and elegant types of sickle we have been considering from Kahun. The thickness of the lower part of the flake is not mere clumsy work, but intentional, as shown by the

trimming round the edges. It is difficult to believe that a groove could have been cut in the wood exceeding one inch in depth, suitable for the reception of such as these, without making the thickness of the blade too clumsy to be useful. It seems probable that these thick, deep teeth, were actually inserted into the jaws of animals from which the real teeth had been extracted.—(*Loc. cit.*)

Dr Schliemann figures[1] a number of the saws so abundantly found in all the five prehistoric settlements of Troy. Many of these would be quite suitable for sickle-teeth, similar to those from Kahun, and I am not, therefore, in a position to say that they had not been so used. Some are very finely serrated, more so than, it would seem to me, was requisite as sickle-teeth. There are, however, among the Hissarlik implements, others which could not have been used as sickle-teeth, even with the instrumentality of a natural jaw-bone as a casing. That represented by Fig. 665 in his above-mentioned work is nearly 2 inches broad, and has a cutting edge 4 inches long. It is squared at both ends, and "bears marks of having been fixed in a wooden handle."

Another, with a slightly longer cutting edge, is thus described :—

No. 1342 is a large silex, with marks on its upper part of its having been cased in a wooden handle. To the many localities enumerated in the preceding pages where similar flint saws are found I can now also add Egypt; for in Fr. Mook's 'Aegyptens vormetallische Zeit' I find a great many silex saws represented, also one (Pl. xiii. 8) made of jasper, found at Helwan in Lower Egypt, which is nearly of an identical shape with the saw

[1] Ilios, pp. 246, 445, and 583.

before us. But I must add that in the fifth prehistoric city of Troy I found only two saws of this shape, and not one of any other shape, though the silex saws occur in such vast abundance in the preceding cities, and particularly so in the fourth.[1]

Both the above-described saws would appear to have been carefully trimmed along their cutting edge, and it may be noted that this edge, in both, is not actually straight, but slightly convex — a feature incompatible with its use as a tooth in a concave sickle-casing. Altogether, the facts seem to me to be entirely favourable to

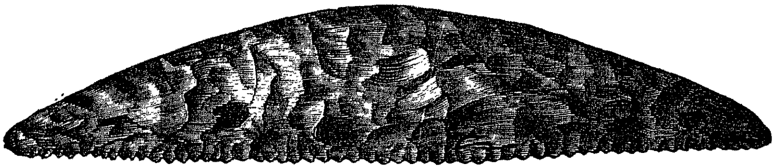


Fig. 119.—*Flint Saw, Bohuslän, Sweden* (½).

Schliemann's interpretation of the manner in which the greater number of these serrated flints had been actually used.

I have looked at the polish on some of the Scandinavian semilunar and crescentic flint implements (Fig. 119), and I agree with Mr Spurrell in regarding it as a feasible result of the operation of cutting corn; and I therefore see no objection to his suggestion that they were used as sickles, except the absence of any direct evidence in its favour. But, in regard to the British and Irish flint saws, the sickle-theory entirely breaks down. There are only very few of these flint saws, owing to their irregularity of form, that could possibly

[1] Ilios, p. 583.

be used as sickle-teeth; and as to the polish occasionally to be seen on them, it is always a narrow band not one-sixteenth of an inch broad, and therefore totally different from that which would be produced by their use as corn-cutters.

In conclusion, we must not forget that our primary basis of facts rests on the productions of two widely distant archæological areas, which must therefore be treated separately and independently of each other. The discovery of these very interesting Egyptian sickles can, at best, be only used as an hypothetical suggestion of the existence of analogous implements outside the limits of Egyptian civilisation. In support of the theory that such sickles were in use among the prehistoric people of Western Europe, I find, in this rapid review of existing materials, little or no evidence. On the other hand, the compound Polada saws are equally suggestive of a wider application, and we may, with greater probability of success, look out for the remains of similar implements among the *débris* of prehistoric civilisations, beyond that of the lake-dwellings of Europe.

II. Notes on Metallic Saws and Sickles.

Since the "Notes on Flint Saws and Sickles" were written, Dr G. A. Colini, of Rome, has published an elaborate article on "Seghe e coltelli-seghe italiani di pietra,"[1] in which he conclusively shows the prevalence

[1] Bull. di Palet. Ital., An. xxii., 1896.

of such implements throughout all parts of Italy. Moreover, he homolgates my views with regard to the double-handed saws of Polada. No doubt similar discoveries, both as regards the number and distribution of flint saws, could be extended to every country in Europe. Thus, flint saws were abundantly met with by MM. Henri and Louis Siret during their explorations among the prehistoric settlements in the south of Spain, no less than fifty-six being recorded as collected in one place (El Argar).[1] But I see no useful object that could be served by dwelling further on this branch of the subject, as the result would be merely to strengthen the conclusions already announced. So far, therefore, as we are concerned with the existing materials of the Stone Age, there is little to be added to what has been said in the first part of this chapter.

The following observations are intended to illustrate the modifications imposed on the saw and the sickle in consequence of the introduction of metals on the field of human civilisation in Europe.

The Transition into the Bronze Age.

As soon as the art of manufacturing bronze became known to a community, tools and implements made of this substance must have quickly superseded those previously in use, owing to the vast superiority of bronze, for cutting purposes, over both stone and copper. But however radical and far-reaching the economical changes thus effected might have been, there is no

[1] Les Premières Âges du Metal, &c., p. 119.

reason to suppose that they were brought about otherwise than by peaceful means, under the influence of the same social culture which prevailed during the Stone Age. This view is strongly supported by the fact that nearly all metallic implements were, in the first instance, mere copies of their stone prototypes. But by-and-by they underwent various modifications, such as might be suggested by a greater experience and knowledge of the properties of the metal, and perhaps also by some practical hints from outside sources. Thus the axe, whether of copper or bronze, was clearly an imitation of the weapon previously made of stone; and a similar relationship can be traced between flint and metal daggers, as may be seen by a comparison of some beautiful specimens found on the lake-dwellings of St Blaise and Vinelz.[1]

The discovery of a number of implements, weapons, and other objects, made of pure copper, is a favourite argument in the armoury of those who advocate that Europe, like Egypt, has passed through a Copper Age. That copper was known in Europe, prior to the art of making it into bronze, is likely enough; but as the pure metal was inferior to flint, for cutting purposes, it produced no perceptible change on the social industries of the period. It was the application of the process of hardening copper, by suddenly raising mankind to a higher mechanical platform, that first stirred up the slow channels of the world's progress. The finding of so many of these primitive copper implements, such as the flat celts, throughout Europe, is no doubt sugges-

[1] Lake-Dwellings of Europe, Fig. 7, No. 11, and Fig. 8, Nos. 2 and 28.

tive of a Copper period; but, at the same time, it must not be forgotten that flat axes of the best quality of bronze have also been found in circumstances which render it probable that they were as ancient as the former. Dr Montelius, one of the most recent advocates of this theory, figures in his *brochure* "Findet man in Schweden Ueberreste von einem Kupferalter" two metal celts, found together in a cultivated field at Pile, in Sweden, which could be used as an argument to prove that bronze was known and utilised in Sweden before copper. One of the celts is a large well-shaped implement, over 8 inches in length, with perpendicular borders and raised edges, and ornamented with a series of curved lines running across its surface. The other is smaller (6 inches in length), and has no raised border, nor indeed any specific character which in appearance would differentiate it from the most primitive type known. But the former is described as being made of copper, and the latter of bronze. The use of pure copper in the manufacture of some of the earlier axes, supposing it had been so utilised before the introduction of bronze, could have lasted only for a very short time—so short, indeed, that during its existence not a single progressive change or improvement is to be noted in regard to any specimen that can be shown to be older than the Bronze Age. No advocate of the theory pretends to say that the assortment of copper objects found in Hungary are all actually earlier than the Bronze Age—many of them being similar in style and pattern to objects regarded as characteristic of this period. The existence of these Hungarian copper implements, like the ornamental

celt from Pile, must therefore be explained on other grounds than the chronological priority of copper over bronze.

Bronze Saws and their Distribution.

But whatever may be the value of these primitive celts as an argument in support of a Copper Age, it entirely fails in the case of saws and sickles, as neither a saw nor a sickle of copper has been found in Central or Western Europe. Yet the direct transition from the flint to the bronze form is as forcibly illustrated by them as by any other class of implement. As regards the sickle, the evolutionary principle is not

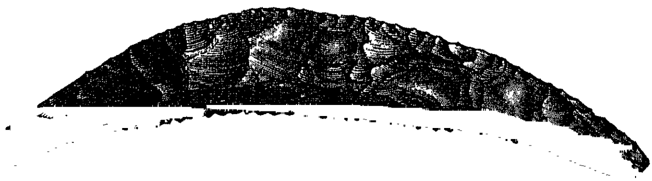


Fig. 120.—*Flint Saw. Sweden* (½).

so transparent, because it is doubtful what kind of flint sickle, if any, was in use in the Stone Age. There is very little change manifested in the transition from the flint to the bronze saw in Southern Europe, both being small, straight-edged tools adapted for the hand, but occasionally inserted into wooden or horn handles. In the Scandinavian archæological area the imitative principle is most convincingly shown by the fact that an exceptional type of saw was here in use. These crescentic or semilunar shaped instruments (Figs. 119 and 120), so extensively used in the Stone Age, were continued with

no alteration, beyond what was entailed by the mere change of material, into the Bronze Age (Figs. 121, 122). This transitional phase is alone sufficient, without the presence of the actual moulds (Fig. 123), to

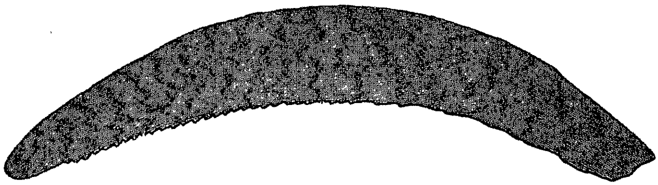


Fig. 121.—*Bronze Saw. Jutland* (½).

prove that they had been manufactured in the locality. The progressive element which runs through these examples (Figs. 120 to 123) is due solely to the change of material, as was first pointed out by Dr Montelius, in

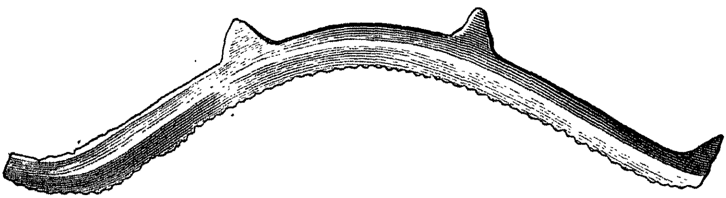


Fig. 122.—*Bronze Saw found in a clay vase in Dalsland, Sweden* (⅝).

1874, at the International Congress of Archæology, then held at Stockholm.[1]

These peculiar flint implements, though very abundant in their special area of production, have rarely been met with outside that area—*i.e.*, Sweden, Denmark, and North Germany; and their analogues in bronze appear to have been equally, if not more, restricted in their distribution, as only one or two

[1] Compte Rendu—Congrès, &c., 7th Session, p. 494.

examples have hitherto been found, which are confined to Sweden and Denmark.

The bronze saws found elsewhere in Europe are invariably small straight-edged blades, made of beaten

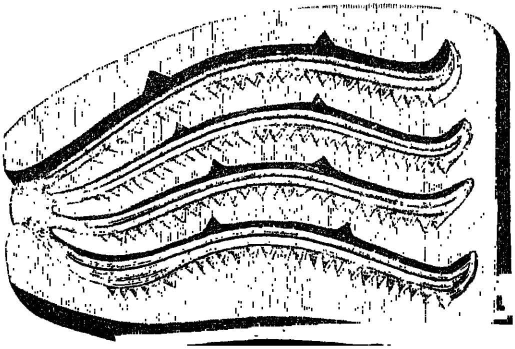


Fig. 123.—*Stone Mould for four Saws, Sweden* (½).

bronze. The largest and finest specimen known (Fig. 124) was found on the lacustrine station of Moeringen. It measures 8½ inches in length and 1¼ inch in breadth, and shows at one end a small rivet-hole. A fragment

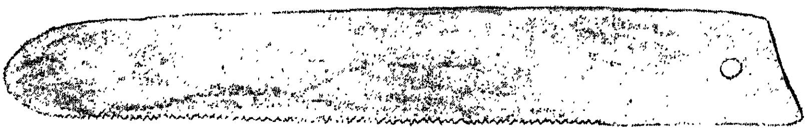


Fig. 124.—*Bronze Saw from Moeringen* (½).

of a similar saw, found at Estavayer, and, when whole, probably as large as the former, is figured in the 'Lake-Dwellings of Europe' (Fig. 12, No. 8). Another from the same locality is figured in Keller's 'Swiss Lake-Dwellings.'[1] Two were found on the lacustrine

[1] English 2d ed., Pl. xcvii. Fig. 3.

stations of Fiolets and Saut, in Lake Bourget.[1] That these tools were rare among the Lake-dwellers is suggested by the fact that, in the vast assortment of relics collected on their ruined habitations, not more

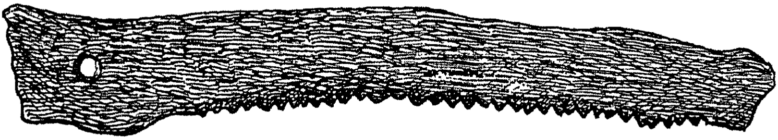


Fig. 125.—*Bronze Saw. Trésor de Ribiers* (*Hautes-Alpes*) (¾).

than half-a-dozen saws can be reckoned. Nor are they much more abundant in the archæological remains outside the lake-dwelling stations. M. Chantre figures one from the "Trésor de Ribiers (Hautes-Alpes)" (Fig. 125), and two from the "Fonderie de Larnaud" (Fig. 126) out of the five contained in this "find." Another is figured in the 'Musée Préhistorique,' by MM. de Mortillet, which shows a rivet-hole in a projecting handle (Fig. 127). Dr Voss informs me that there is only one specimen in the Museum für Völkerkunde. It came from Bucholz, in the Süderdithmarschen of Holstein (Fig. 128), and it is interesting to notice that it was found in an urn containing cremated human remains. In the great hoard known

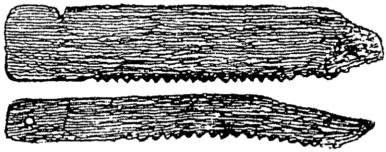


Fig. 126.—*Two Bronze Saws. Fonderie de Larnaud* (*Jura*) (⅔).

Fig. 127.—*Bronze Saw with a projection and rivet-hole for handle. Musée St Germain* (about ½).

[1] Chantre, Âge du Bronze, Pls. lvi. and lvii.

as the "Fonderia di Bologna" there were some twenty-seven fragments of bronze saws, showing a great diversity in the size of the teeth. The largest of the fragments is about three inches long and 1 inch broad. One has a small tang with a rivet-hole, and another has both its edges serrated.

Fig. 128.—*Bronze Saw found in an urn with burnt human bones at Bucholz, Holstein* (⅔).

Among a number of bronze objects (Ripostiglio del Goluzzo) found near Chiusi were two fragments of a saw, measuring 7 inches in length and 1 inch in breadth, and having a button-like knob at one end.[1]

The Hungarian portion of the valley of the Danube

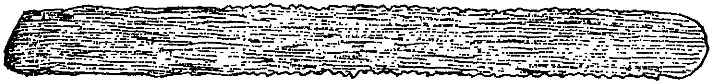


Fig. 129.—*Bronze Saw from Hungary. Fonderie de Borjas* (⅔).

has supplied more saws than all the rest of Europe together. They are mostly fragments of thin blades found in the numerous bronze hoards which have, in later years, been discovered in this region. Professor Hampel, in his "Statistiques des Trouvailles de l'Âge du Bronze,"[2] mentions upwards of a dozen localities which have yielded one or more saws (all fragments except two). Some of these are figured on Plates 17, 90, 95, 97, 106, and 108 of the above-named work. A bronze saw in the private collection of M. Théodore Lehóczky

[1] Bull. di Palet., An. xiii., Pl. iii. No. 11.
[2] Congrès International, &c., 1876, vol. ii.

is 8 inches in length and 1 inch in breadth; and another from the "Fonderie de Borjas" is about 4½ inches long (Fig. 129).

M. F. Fiala, in his well-illustrated article on the prehistoric settlement of Debelobrdo, near Sarajevo, Bosnia, figures a fragment of a bronze saw (Fig. 130).[1]

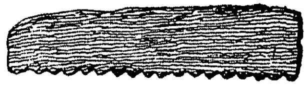


Fig. 130.—*Fragment of a Bronze Saw from the prehistoric settlement of Debelobrdo, Bosnia* (½).

M. Cartailhac gives an illustration of a small bronze saw, 4¼ inches long, which tapers with a slight curve towards one end, and has two notches at the other. It was found at "Fonte da Ruptura," near Sétubal.[2] MM.

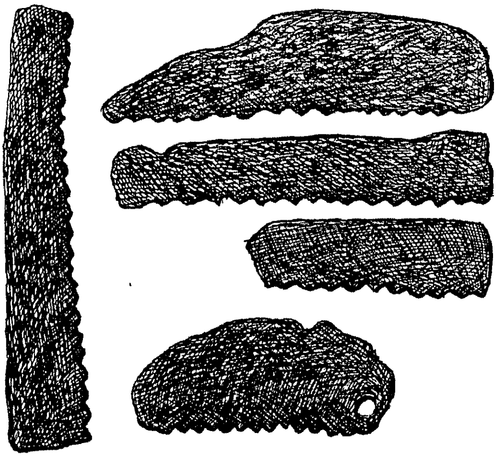


Fig. 131.—*Bronze Saws from Spain. After Siret* (¾).

Henri et Louis Siret, in their magnificent work on "Les Premières Âges du Metal," also figure a few small specimens of various forms, as shown on Fig. 131.

[1] Wissen. Mitt. aus Bosnien und der Hercegovina, vol. iv. p. 61.

[2] Âges Préhistoriques de l'Espagne, p. 220.

Bronze saws have not been found either in Britain or Ireland, unless the following statement of Sir John Evans justifies one exception :—

A fragment of what has been regarded as a rudely formed saw of bronze was indeed found, with a sword and several celts, at Mawgan, Cornwall, and is now in the Museum of the Society of Antiquaries. It is 4 inches by ¾ inch, coarsely toothed, and the serrations appear to have been cast. I am, however, rather doubtful whether it was really a saw.[1]

Bronze Sickles and their Distribution.

A sickle may be regarded as a curved knife, or a curved saw when the edge is serrated, as in the "corn-hooks" which, till lately, were used in this country. The ancient bronze sickles were all of the former kind

Fig. 132.—*Bronze Sickle from the Lake-Dwelling of Estavayer* (½).

—*i.e.*, without a serrated edge. Judging from the numbers to be seen in archæological museums throughout Europe, especially in those of its central and southern parts, agriculture must have been extensively carried on in the Bronze Age. They have been found in all sorts of

[1] Ancient Bronze Implements, &c., p. 184.

localities—the ruins of ancient habitations, the sites of lacustrine villages, founders' hoards, graves, &c. They present well-marked differences in different localities, arising chiefly from the various methods adopted in hafting them. Sometimes there is a rivet-hole and a small projecting spur at the butt-end (Fig. 132), showing that the implement had been hafted by being inserted up to the spur into a prepared slit in the wood (Fig. 133). But the rivet was by no means an essential element in the fastening, as may be seen from a group of sickles—part of a hoard found in Bosnia—in none of which is there a rivet-hole (Fig. 134). All these implements differ slightly in form and in the arrangement of the nervures, but as a whole they are so similar to the specimens prevalent in Hungary that there can be no doubt they were imported into Bosnia from that country.

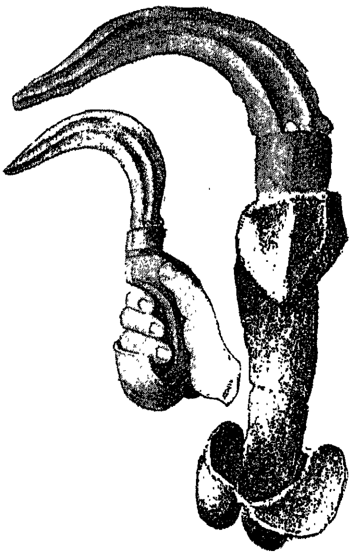


Fig. 133.—*Wooden handle with Sickle from Moeringen* (⅓).

Another mode of hafting the sickle was by a raised button-like projection, left in the metal in place of the rivet-hole (Figs. 135, 136), which fitted into a corresponding cavity in the handle, and was then firmly fixed by some kind of binding. This arrangement seems to be a practical development of the idea of casting the blade with the rivet in position.

Both these types were flat on the underside, but on the upper they had one or more ridges, running parallel to the back, which served the double purpose of strengthening and ornamenting the blade. It may also be noted that they could have been readily cast in a single open mould—the plain underside of the sickle

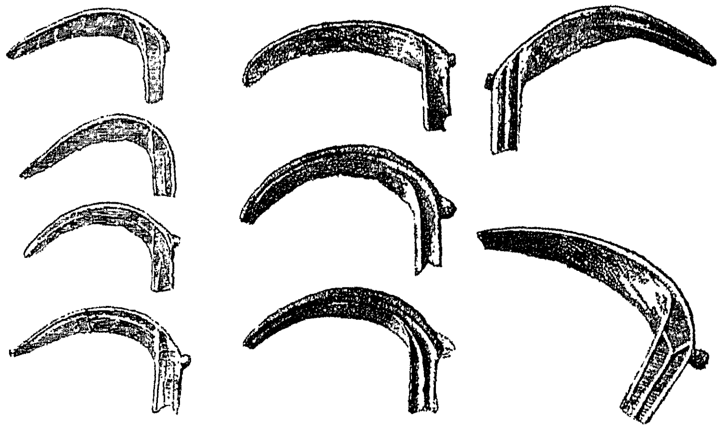


Fig. 134.—*Bronze Sickles found in Bosnia (portion of a hoard).*

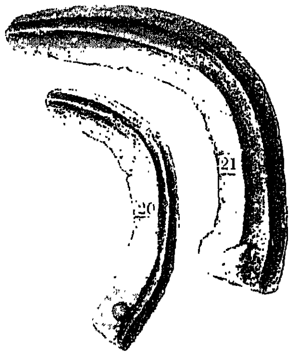
being the horizontal upper surface of the casting. That, however, they were also moulded in the usual way by the proper adjustment of two valves is proved by the finding of some of the valves so used.[1]

In Hungary both types are met with, but not in the same numbers — those with the raised button being fewer. There is also another kind, occasionally to be seen in that country, which is supposed to be more modern than either of the former—viz., that in which the butt-end was transformed into a tang for insertion

[1] See Keller's 'Swiss Lake-Dwellings,' Pl. lxxv. Fig. 5; and 'Bull. di Palet. Ital.,' An. xiii., Pl. vi. Fig. 2.

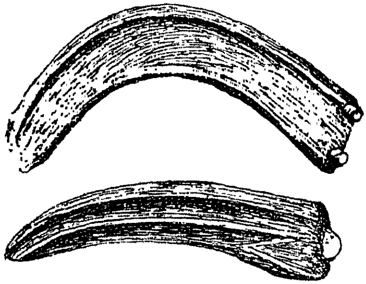
into the handle. Dr Hampel, in his statistical account of the Hungarian Bronze finds, gives a number of illustrations,[1] and states that they are of eastern origin—their special home being Transylvania.

Lastly, we have the method of hafting by a socket at one end of the blade, into which the handle was inserted. The special area of development of this class is confined almost exclusively to the British Isles, throughout which, though not numerously, the specimens have been widely distributed. This limitation in their distribution is more remarkable when we consider that within the



Figs. 135, 136.—*Bronze Sickles from Lake Bourget* (⅓).

same area, with the exception of one or two discoveries in the western counties of England, no other types are known. The exceptions are four specimens found in a hoard in a turbary at Edington Burtle,[2] two on Sparkford Hill[3]—both these localities being in the county of Somerset—and two at Taunton. All these sickles are of the raised-button type, but, curiously enough, most of them have two



Figs. 137, 138.—*Two Sickles found at Edington Burtle, Somersetshire* (⅓).

[1] Loc. cit., Pl. xv.

[2] Somerset Arch. and Nat. Hist. Proc., vol. v. p. 91.

[3] Ibid., vol. vii. p. 27.

buttons (Figs. 137, 138), instead of one as was invariably the case with the Continental sickles. Another, but characterised as a doubtful specimen, is a thin slightly curved blade with a rivet at one end found at Marden in Kent.[1] Sir John Evans, in his 'Ancient Bronze Implements of Great Britain,' traces the discovery of eight socketed sickles found in various counties in

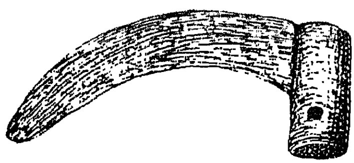


Fig. 139.—*Bronze Sickle found in the Thames. Coll. Evans* (⅓).

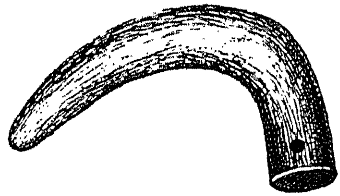


Fig. 140.—*Bronze Sickle found in the Thames near Bray* (⅓).

England. Three, dredged from the bed of the Thames, are here roughly sketched (Figs. 139-141), so as to show their form and method of hafting.

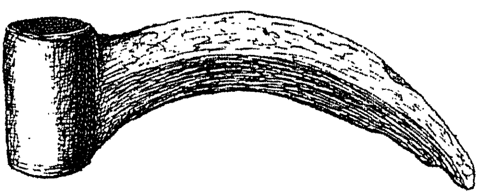


Fig. 141.—*Bronze Sickle found in the Thames near Windsor.*

In Scotland some six bronze sickles are known to have been found; but only three, so far as I know, are now extant. One, found in the Tay, near Errol, is preserved in the Perth Museum (Fig. 142). Another (Fig. 143), found at Edengerach, Premnay, Aberdeenshire, and a third, from the parish of Dores, Inverness-

[1] Arch. Association Journal, vol. xiv. p. 258.

shire (Fig. 144), are preserved in the National Museum of Antiquities in Edinburgh.[1]

In Ireland bronze sickles have been more numerously

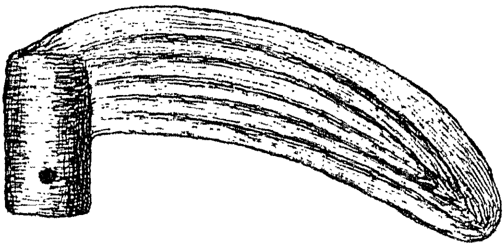


Fig. 142.—*Bronze Sickle found in the Tay near Errol. Blade 6¼ inches long.*

found than either in England or Scotland. Eleven specimens are mentioned in Wilde's Catalogue to the Museum of the Royal Irish Academy, while several

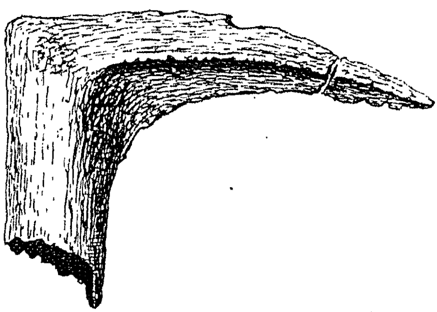


Fig. 143.—*Bronze Sickle at Premnay, Aberdeenshire. Blade 4½ inches long.*

more are said to be in the British Museum, London, in the National Museum of Scotland, and in some local collections. They were all made after the three patterns illustrated by the accompanying woodcuts (Figs.

[1] See 'Proc. Soc. Ant. of Scotland,' vol. viii. p. 375, and vol. xxiv. p. 447.

145, 146, and 147), and show merely slight variations in their structural or ornamental details. The majority are made after the form represented by Fig. 145.

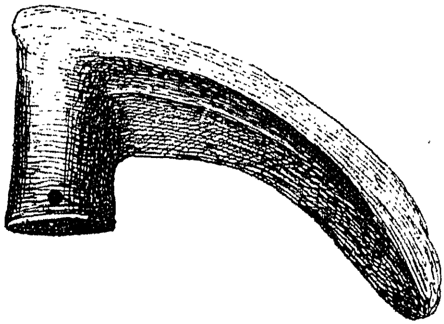


Fig. 144.—*Bronze Sickle, parish of Dores, Inverness-shire.* 5¼ *inches in length.*

Thus, like most of the other industrial implements and weapons—knives, spear-heads, arrow-points, axes, &c.—the sickles appear to have passed through certain

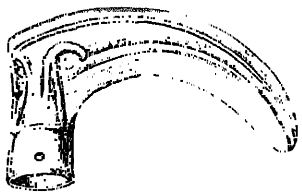


Fig. 145.—*Bronze Sickle found in Ireland.* 6¼ *inches long.*

Fig. 146.—*Bronze Sickle found in Ireland.* 6¾ *inches long.*

stages of development, especially as regards the method by which they were fixed to the handle; but it is difficult to determine what was the precise chronological order of these progressive improvements. MM. de Mortillet consider the sickles with a raised button the oldest, and maintain that this button, or knob, was originally the terminal portion of the blade slightly turned up.[1]

[1] Musée Préhistorique, Nos. 723-726.

In drawing a comparison between these sickle-transformations and the analogous stages through which the axe has passed, we would almost naturally infer that the application of a socket to the sickle-blade was its latest improvement, as it is universally admitted among archæologists that the socketed celt was the final form of the axe in the Bronze Age.

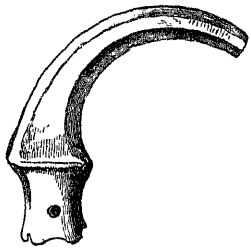


Fig. 147.—*Bronze Sickle found in Ireland. Length 7 inches.*

There are, however, so many curious anomalies in the distribution of the various forms of these implements that the selection of one type in preference to another, in certain localities, would appear to be due not so much to the technical process of development as to other and local causes. Thus, the socketed knives were extremely rare in all the lake-villages of Eastern Switzerland, not a single example having been recorded from the very rich bronze station of Wollishofen; but from this westwards they gradually increased in numbers, till in Lake Bourget they became the majority. On the other hand, not a single specimen of a socketed sickle has been found in any of the stations of this lake. Then, again, sickles with raised buttons are extremely rare among the relics of the lacustrine stations in the Jura valley, but in Lake Bourget, out of twenty-three specimens, nearly all are of this type. They are also the prevalent, if not the exclusive, forms found in the Scandinavian archæological area (Fig. 148), as may be seen from the illustrations in Scandinavian works. Finally, it is a very remarkable fact that socketed sickles

have not been found on the Continent, with the exception of three in France,[1] and a fragment of one in the lake-dwelling of Corcelettes.[2]

In Hungary sickles are very abundant, the flat forms without a rivet-hole being the most numerous, and the

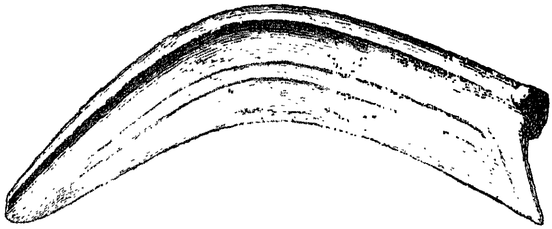


Fig. 148.—*Bronze Sickle from Södermanland, Sweden* (½).

strengthening ribs or nervures are so arranged as to give them a highly decorated appearance (Fig. 134).

Sickles, as well as their moulds, are also among the

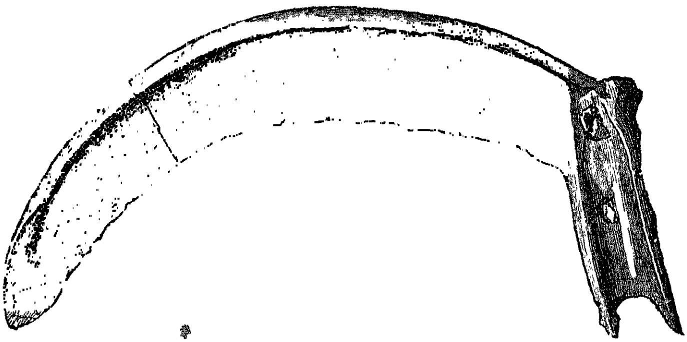


Fig. 149.—*Bronze Sickle from Campeggine, Italy* (½).

relics disinterred on the Terramara-mounds of Italy, from which we find that it was the flat type which found favour with their inhabitants (Fig. 149). Be-

[1] Evans, Ancient Bronze Implements, p. 202.
[2] Gross, Les Protohelvètes, p. 43.

sides the sickle-mould already referred to on p. 340, Professor Coppi has figured one from the Terramara of Gorzano.[1]

From the illustrations already given it will be seen that the bronze sickles vary greatly in shape, some being nearly straight and others gracefully curved like Fig. 132; but it is unnecessary to add illustrations of such minor differences.

Saws and Sickles in the Early Iron Age.

The art of manufacturing iron, according to the evidence furnished by archæological researches, sprung from the Old-World civilisations bordering on the eastern shores of the Mediterranean, and thence spread westwards into European lands. The earliest remains of the Iron Age in Europe belong to what is known as the Halstadt period, representing a civilisation so totally different from anything previously known in Europe that its elements are by all recognised as unquestionably of foreign origin. It extended over a considerable area in the regions surrounding the head of the Adriatic, where it flourished for many centuries, and gave rise, under the influence and genius of the Celtic races, to the La Tène civilisation, the remains of which are still found scattered over the whole of Western Europe. Its characteristic implements, tools, and weapons are strongly differentiated from those of the Bronze Age. Their owners are identified as the Galli of history who, in proto-historic times, became a terror to the other Euro-

[1] Monog. ed inconog., &c., vol. ii., Pl. lxv.

pean races. These La Tène relics, in Gaul, interpose, chronologically, between those of the Bronze Age and the Roman period; and it is among them we have to look for the modifications effected in industrial implements in consequence of the introduction of iron into general use. The saws do not appear to have deviated much from the forms prevalent in the Bronze Age, being still represented as hand implements, slightly larger than their bronze prototypes. An iron saw, de-

Fig. 150.—*Iron Saw from a Gallo-Roman Cemetery at Esino, North Italy* (½). *After Castelfranco.*

scribed by P. Castelfranco[1] as found in a Gallic tomb at Esino in North Italy, contains a rivet-hole at each end (Fig. 150). It is 14 inches long and 1¾ inch broad. Another fragment found in the same grave was slightly broader. Iron saws are also among the relics found on the site of the Oppidum La Tène in the lake of Neuchâtel. Two in the collection of E. Vouga are figured on Pl. VIII., Nos. 24 and 25, along with a number of other objects from the same locality. These saws still retain their handles, one (No. 24) being of wood and the other (No. 25) of bone. Another on this plate (No. 29) has a solid iron handle, and terminates at the point in a curiously shaped curve.

Among a number of tools and implements found on the crannog of Lagore, Ireland, and now preserved in the Museum of the Irish Academy, are some small iron

[1] Bull. di Palet., An. xii., p. 209.

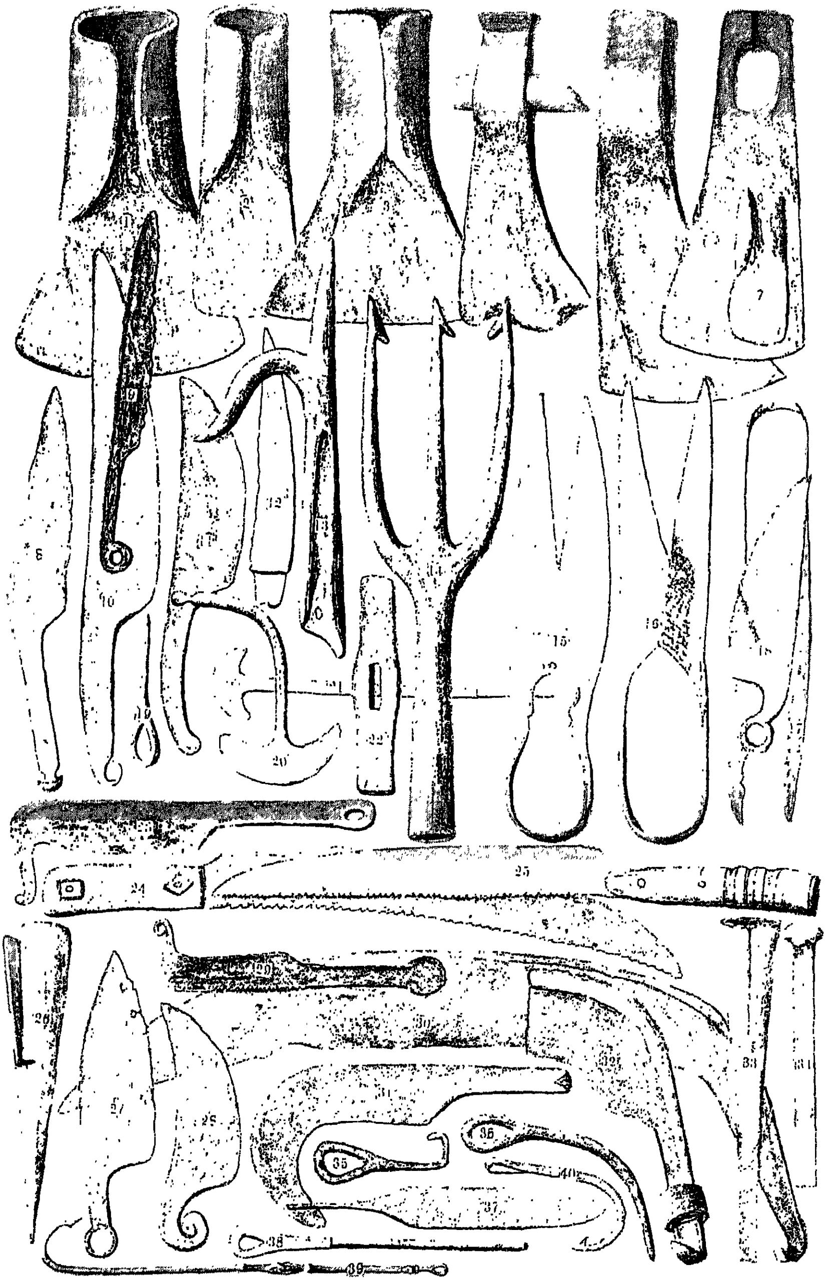


Plate VIII.

SAWS, SICKLES, AND OTHER IMPLEMENTS OF IRON, from La Tène.

All ¼ real size.

saws, two of which are figured in 'The Lake-Dwellings of Europe' (Fig. 106, Nos. 7 and 8).

Portions of what looked like a cross-cut saw were picked up on the crannog of Lochlee, which together measured 38 inches in length with an average of 3 inches in breadth; at one end there was a rivet-hole.[1]

In 1896 Professor Flinders Petrie exhibited, at the Loan Collection of the British Association at Liverpool, a set of iron tools (said to be of the seventh century B.C.) lately discovered in Egypt, and among them were a rasp, a file, and three saws. The latter were small, and each had a rivet-hole for fixing the handle. Dr Petrie believes them to be of Assyrian origin, such tools being quite unknown in Egypt till later times.

The sickles of the Iron Age were much larger than those of the Bronze Age, and, like our modern corn-hooks, were often furnished with teeth. M. E. Vouga has figured a couple of such implements, found on Oppidum La Tène, which possess a pointed tang for insertion into a wooden handle.[2] Other examples of the same type have been found on the lake-dwelling stations of Morges, Sipplingen, and Moeringen.[3] Those without teeth assumed large proportions and developed into scythes, as shown on Pl. VIII., Nos. 30, 31, and 32.

General Remarks.

Under the words *Serra* and *Falx*, in Smith's 'Dictionary of Greek and Roman Antiquities,' some inter-

[1] Ancient Scottish Lake-Dwellings, Fig. 43.
[2] Les Helvètes à La Tène, Pl. xiii.
[3] Keller, Swiss Lake-Dwellings, English ed., pp. 126, 163, and 300.

esting information is given in regard to the forms and uses of saws and sickles in proto-historic times. According to classical authors the origin of sawing was then lost in the mythical ages. Pliny,[1] in describing the method of cutting marble slabs, attributes the effective work of the machine to a special sand which was used, and which the to-and-fro action of the iron saw pressed into the marble, and so ground it down. As a parallel to this I may be permitted to quote a statement made by Professor Flinders Petrie, in answer to a question put to him at the Ipswich meeting of the British Association, that the ancient Egyptians sculptured granite by means of copper tools and emery. These facts are extremely interesting when compared with the methods by which the Neolithic inhabitants of Europe manufactured their stone implements. Writing in 1890, I thus described these methods :—

The skill displayed in the manufacture of the perforated stone axes and hammers has often excited the astonishment of antiquaries; and many of them thought that it was hardly possible to bore perfectly round or oval holes through such hard materials without the use of metal tools. Yet this was undoubtedly done, as we find not only bored implements, but smoothly sawn portions, in the very earliest stations, as, for example, Schaffis, Moosseedorf, Wangen, Robenhausen, &c. From the former there are in the Berne Museum stone celts with a round hole and one with an oval-shaped perforation. Quite as inexplicable are the numerous fragments of stone, clearly indicating, from the parallel grooving, that they were sawn off. Some of these pieces are by no means small, and such as could be readily accounted for by the use of flint saws. In the Museum of Zurich there is a large water-rolled stone of

[1] Hist. Nat., xxxvi. chap. 9.

serpentine, measuring 14 by 9 by 8 inches, which was dredged up at Wollishofen, showing a cut 11 inches long and $\frac{5}{8}$ inch deep. One side of the cut was broken off, but the fragment was fortunately also recovered, and when made to fit in its place, which it does to a nicety, the maximum breadth of the cut can be readily ascertained to be $\frac{3}{8}$ of an inch. The sides of this cut are finely striated with parallel grooves, which are not exactly straight, but bent slightly downwards in the middle. Before the sawing was begun there are clear indications of a superficial groove having been made by chipping, evidently with the intention of guiding the saw in the initiatory stages of the process. What could this saw have been made of? I do not think that with a flint implement this cut could have been made. It is as regular as that from a modern steel instrument. It is now supposed that the sawing of stones was performed with a thin wooden board and some dry sand. The late Dr Keller experimented with these simple means, and found that they were quite sufficient for the purpose. He also practically proved that in the same way, with a wooden tube set in rapid motion round its axis, he could easily bore a hole in the hardest stone. Any one visiting the Museum in Zurich may practically test the efficacy of these processes for himself, and the obliging custodian delights in showing the method of working. Soft wood is found to be better than hard, as the former takes up more of the particles of the sand, which act like fine teeth in grinding the stone. That tubes of some kind were used for boring stones by the lake-dwellers is demonstrated by the finding of hundreds of round cores, the result of boring on this principle, as well as, sometimes, implements with the boring begun but incompleted, showing the round core still in the hole as shown in Fig. 184, No. 6. In the Zurich Museum there is also a staghorn hammer from Robenhausen with a partially bored hole having a core in its centre, thus proving that horns were also manipulated in the same way (Fig. 24, No. 12).[1]

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[1] Lake-Dwellings of Europe, p. 504.

Summary.

In briefly summarising the substance of these observations on prehistoric saws and sickles, the following are some of the general and more important conclusions arrived at:—

1. The knife came first into use as a sharp stone splinter; and flint, being the material best adapted for cutting purposes, was soon adopted preferentially for its manufacture wherever it could be found. The to-and-fro motion, so readily resorted to when using such implements, was by degrees recognised as a separate action, and so it gave rise to the manufacture of special blades with serrated edges. This distinction between sawing and cutting took practical effect, at least, in later quaternary times. In the Neolithic period saws were fixed into horn or wooden handles, and, in order to increase the sawing edge, more than one flint were sometimes fixed in the same casing, as illustrated by the compound saws of Polada and the Egyptian sickles.

2. As soon as bronze passed into current use in the arts and industries, saws were also made of this material, but only in limited numbers, owing, probably, to the more restricted nature of the work assigned to them, the sharp knives introduced at the same time being better adapted for doing work which formerly had to be done with a see-saw motion.

3. In Great Britain and Ireland flint saws, prepared

with great care and furnished with very fine teeth, were probably used in the Bronze Age, as no bronze saws have hitherto been found in these islands. On looking at a specimen from the Culbin Sands, recently sent to the National Museum of Antiquities in Edinburgh, I counted thirty beautifully defined teeth on a linear edge of $1\frac{1}{8}$ inch.

4. In Europe no well-authenticated example of a saw, or a sickle, made of pure copper has come to light, probably for the reason that this material was too soft to be utilised for the process of sawing hard materials.

5. It is not known what kind of sickle was used in the Stone Age. The ears of corn could have been cut off by the small flint saws so common during the period. The suggestive hypothesis, that wooden sickles, with flint teeth like those found at Kahun in Egypt, were used in European lands, still awaits the test of practical research.

6. Bronze sickles have been recorded, in more or fewer numbers, from nearly all parts of Europe, with, perhaps, the exception of the Iberian peninsula, in regard to which archæological records are very scanty. Owing to local and technical influences, they vary in so many respects as to be capable of subdivision into groups, occupying sometimes special geographical areas. Thus, those with a raised knob for fixing the handle predominated in Western and Northern Europe, except in the British Isles, where the socketed sickles almost exclusively had been used. In Italy, Hungary, Bohemia, and the eastern lake-dwellings of Central Europe, the

flat forms, with many slight variations, were preferred to all others.

7. In the early Iron Age the sickle, besides being much larger than its bronze prototype, gave origin to another implement—viz., the scythe: otherwise the modifications to which the saw and the sickle were subjected, in consequence of the spread of a knowledge of iron into European lands, consisted merely in increasing their efficiency by giving them larger dimensions.

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